

# Exhibit 2

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**UNITED STATES DISTRICT COURT**  
**NORTHERN DISTRICT OF CALIFORNIA**  
**SAN FRANCISCO DIVISION**

GOOGLE LLC,

Plaintiff

v.

SONOS, INC.,

Defendant.

CASE NO. 3:20-cv-06754-WHA

Related to CASE NO. 3:21-cv-07559-WHA

**OPENING EXPERT REPORT OF DR. DAN SCHONFELD REGARDING CLAIM 1 OF  
U.S. PATENT NO. 10,848,885**

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disclosed by Squeezebox because it can or may not play back music, as shown above.

351. As shown above and discussed in more detail below, a Squeezebox or Softsqueeze can play back media individually. There may be multiple Squeezeboxes or Softsqueezes operating on the network at the same time. *E.g.*, IA at 74 (“Yes, you can have any number of Squeezeboxes on your LAN”), 99, 312.

(vii) *Limitation 1.6: “(i) receiving, from a network device over a data network, a first indication that the first zone player has been added to a first zone scene comprising a first predefined grouping of zone players including at least the first zone player and a second zone player that are to be configured for synchronous playback of media when the first zone scene is invoked; and”*

352. In my opinion, the Sonos System discloses this claim limitation.

353. Sonos discussed this claim limitation, in part, in its summary judgment briefing. As I discussed *supra* in Section X, Sonos argued that adding a speaker to a speaker group via a controller and sending an “indication” that need not include the “zone scene” or the players in that zone scene is sufficient to meet this claim limitation.

354. Squeezebox discloses this behavior. The claim limitation requires the Squeezebox to receive information from a network device over a data network. The network device may comprise the SlimServer running on a computer, which allows a user to control Squeezeboxes remotely over Wi-Fi or wired data networks. Squeezebox receives a first indication in the form of network messages passed from the controller and that later permit the Squeezebox to synchronously playback media with other Squeezeboxes when the named group of Squeezeboxes is invoked by selecting that “zone scene” for synchronous playback.

355. I have provided below screenshots of certain testing performed on physical

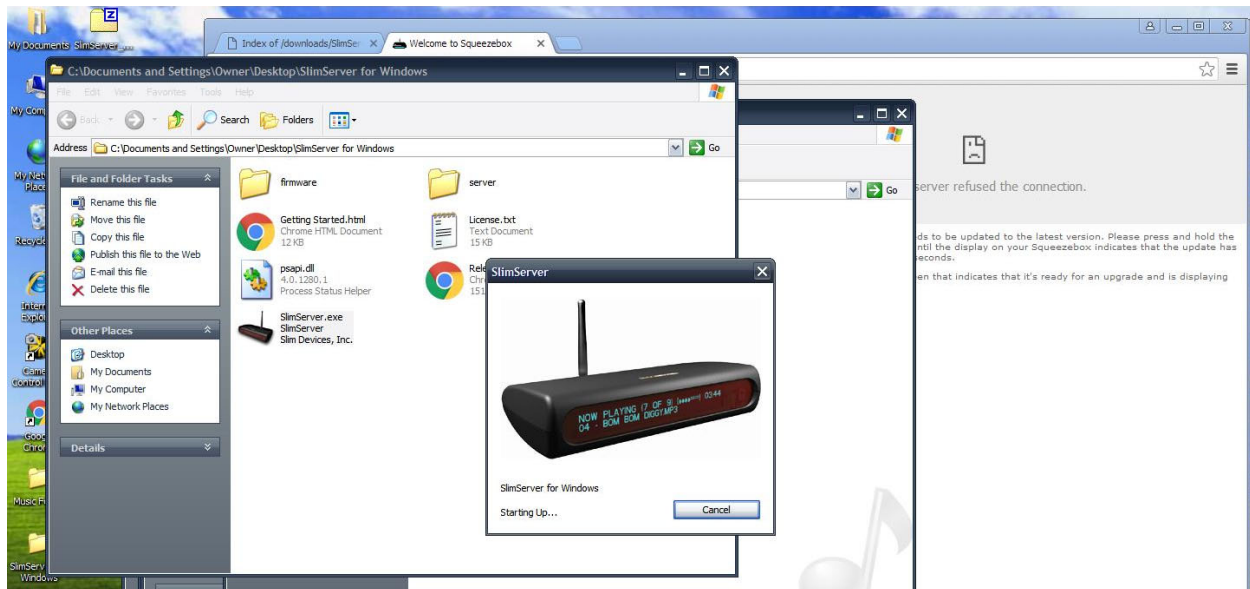
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Squeezeboxes. This testing was performed on SlimServer version 5.3.1, which was available October 2004, and I have confirmed that other versions operate similarly.

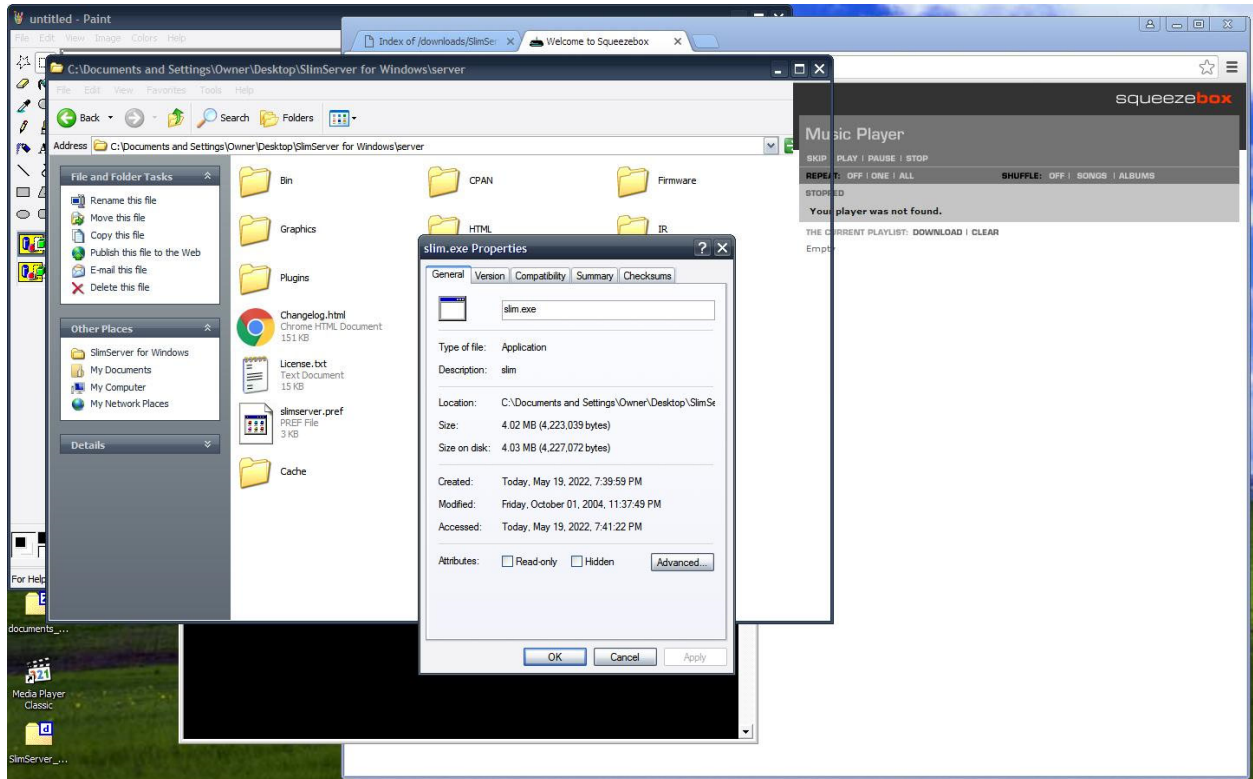
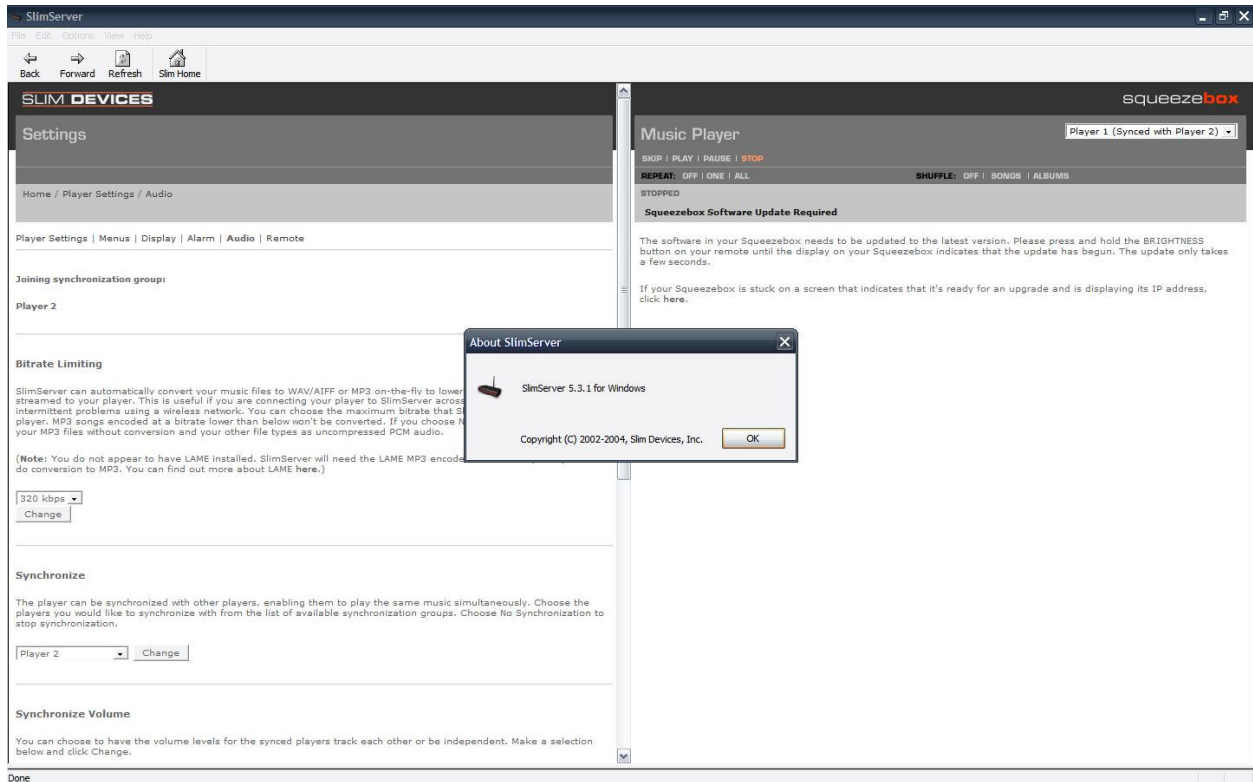
<https://downloads.slimdevices.com/>; [https://downloads.slimdevices.com/SlimServer\\_v5.3.1/](https://downloads.slimdevices.com/SlimServer_v5.3.1/).

The testing was performed with a prior art laptop running prior art operating system software made available for inspection to Sonos.

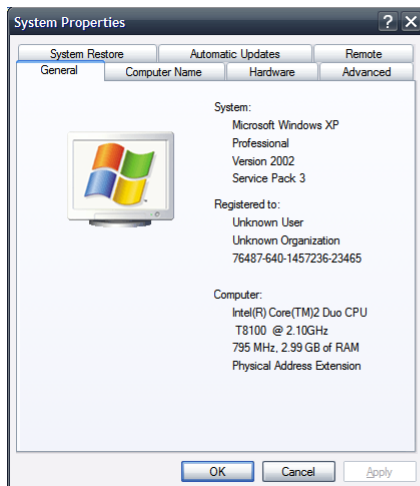
Name	Type	Compressed size	Password ...	Size	Ratio	Date modified
firmware	File folder					10/1/2004 2:37 PM
server	File folder					10/1/2004 2:37 PM
Getting Started.html	Chrome HTML Document	4 KB	No	12 KB	64%	10/1/2004 2:37 PM
License.txt	Text Document	6 KB	No	15 KB	62%	10/1/2004 2:37 PM
psapi.dll	Application extension	23 KB	No	45 KB	49%	10/1/2004 2:37 PM
Release Notes.html	Chrome HTML Document	49 KB	No	151 KB	68%	10/1/2004 2:37 PM
SlimServer.exe	Application	230 KB	No	512 KB	56%	10/1/2004 2:37 PM



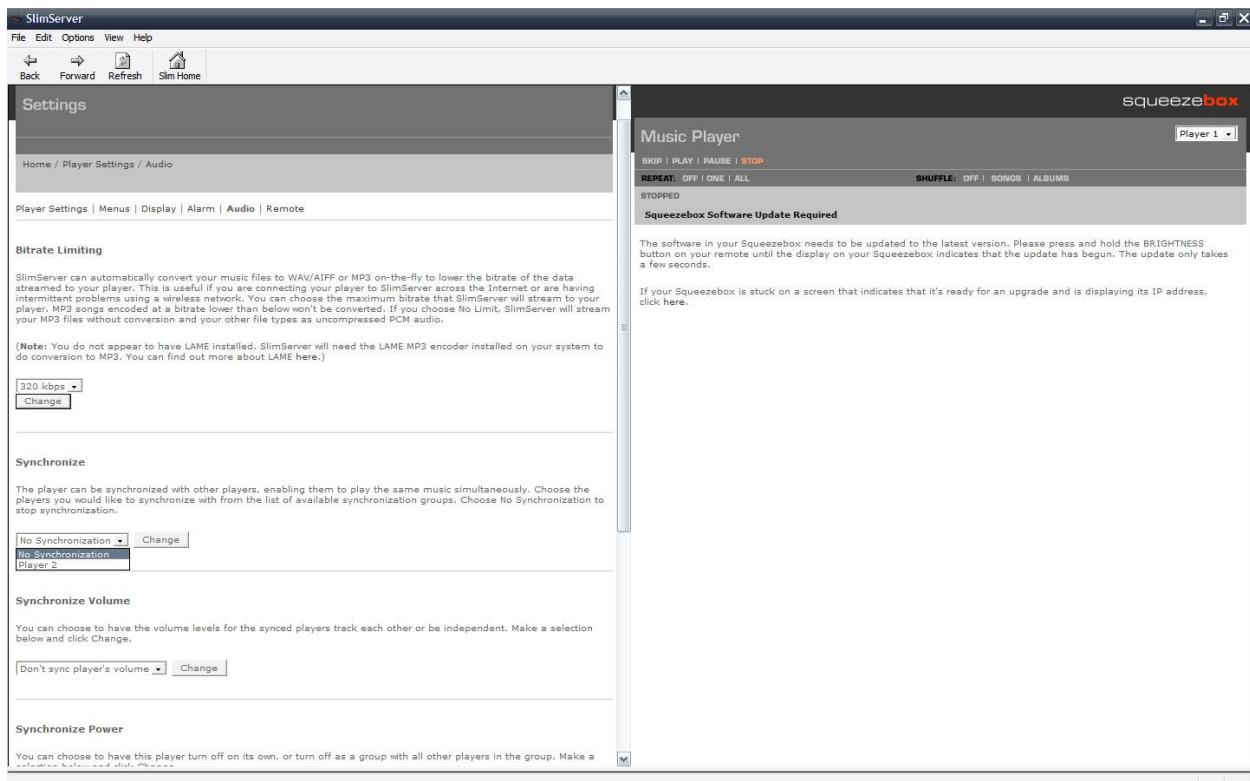
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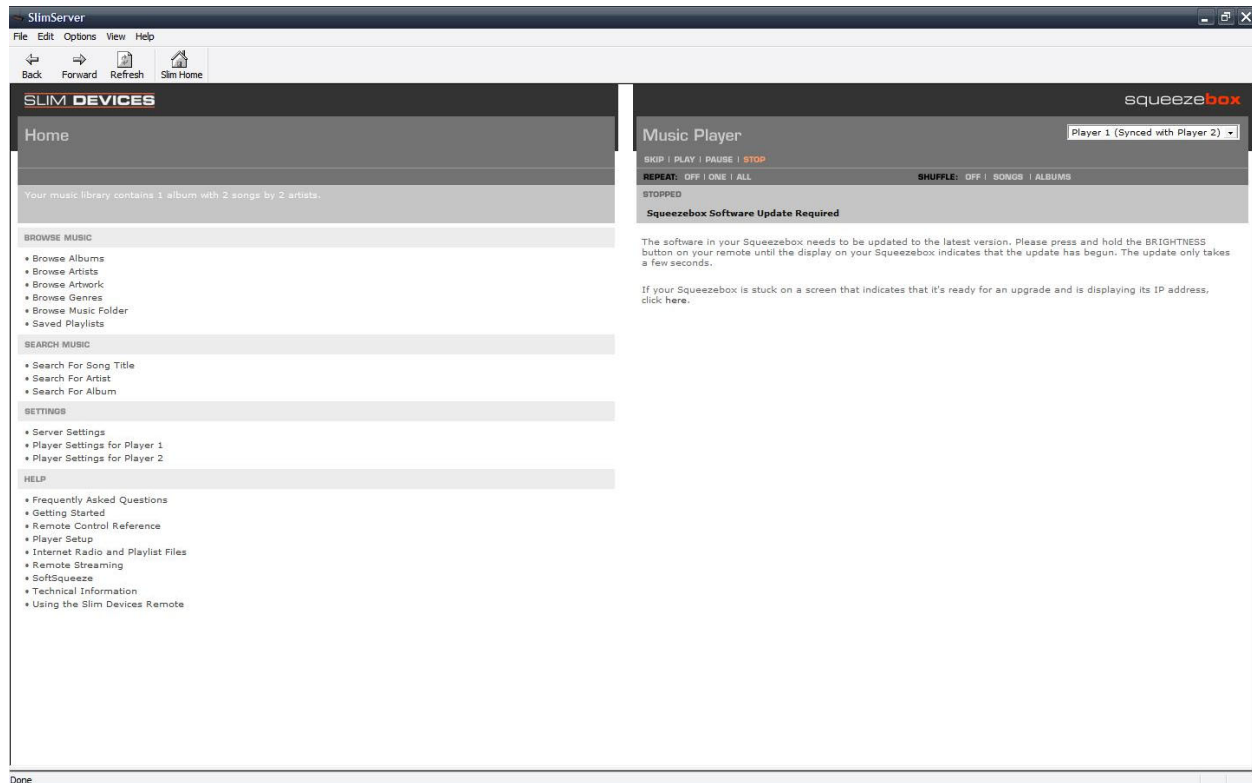
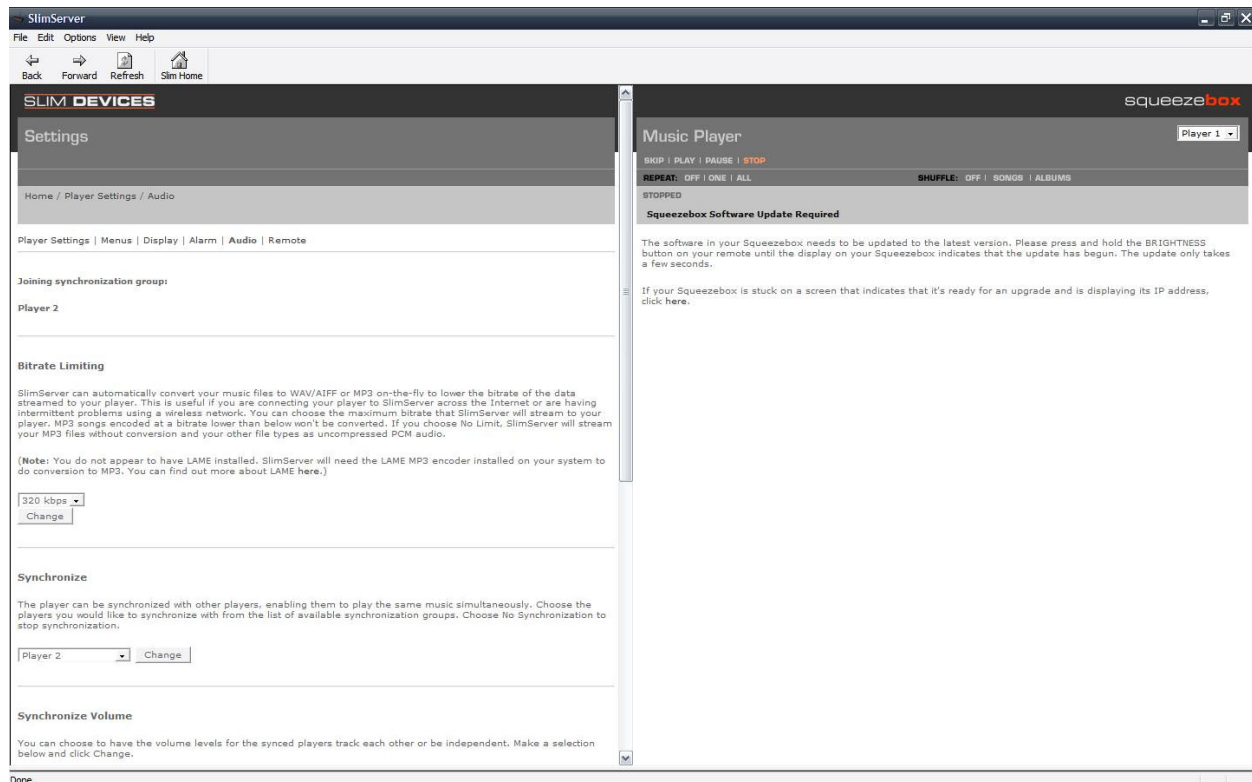
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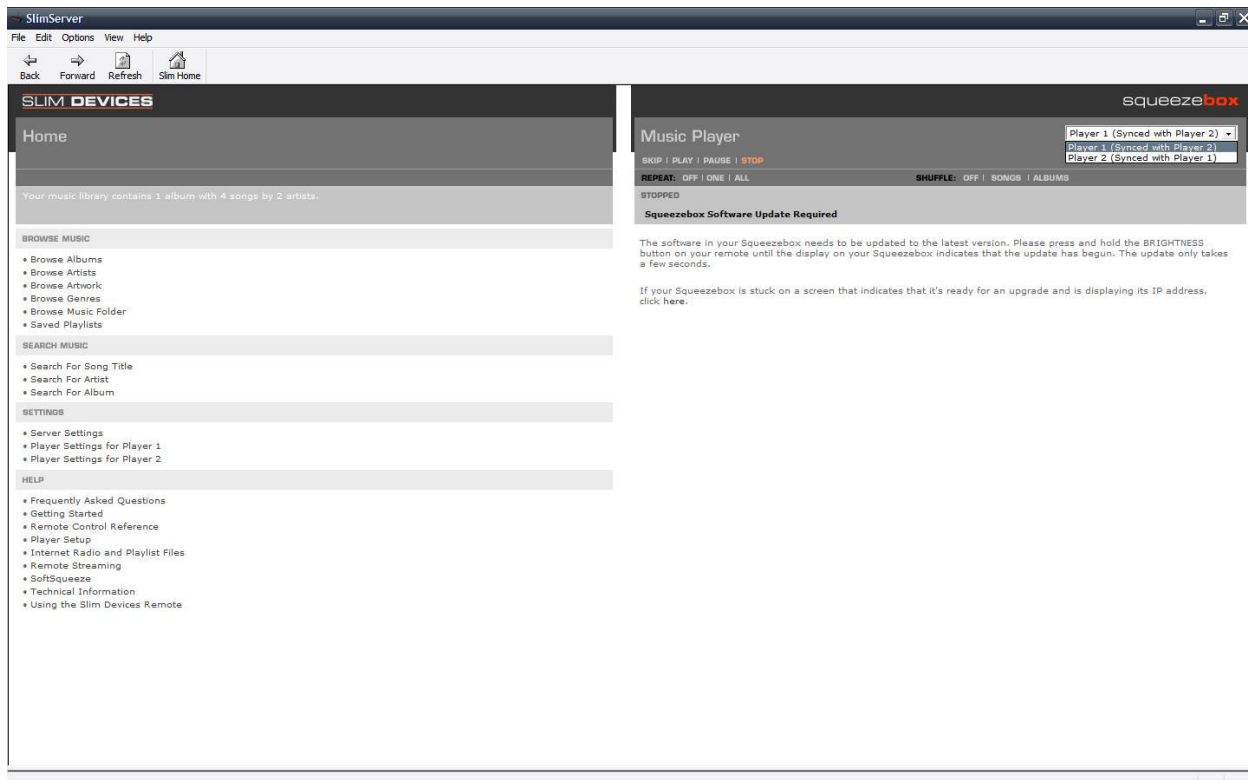
356. As shown below, the SlimServer allows a user to group together different Squeezebox and Softsqueeze players so that synchronous playback is performed.



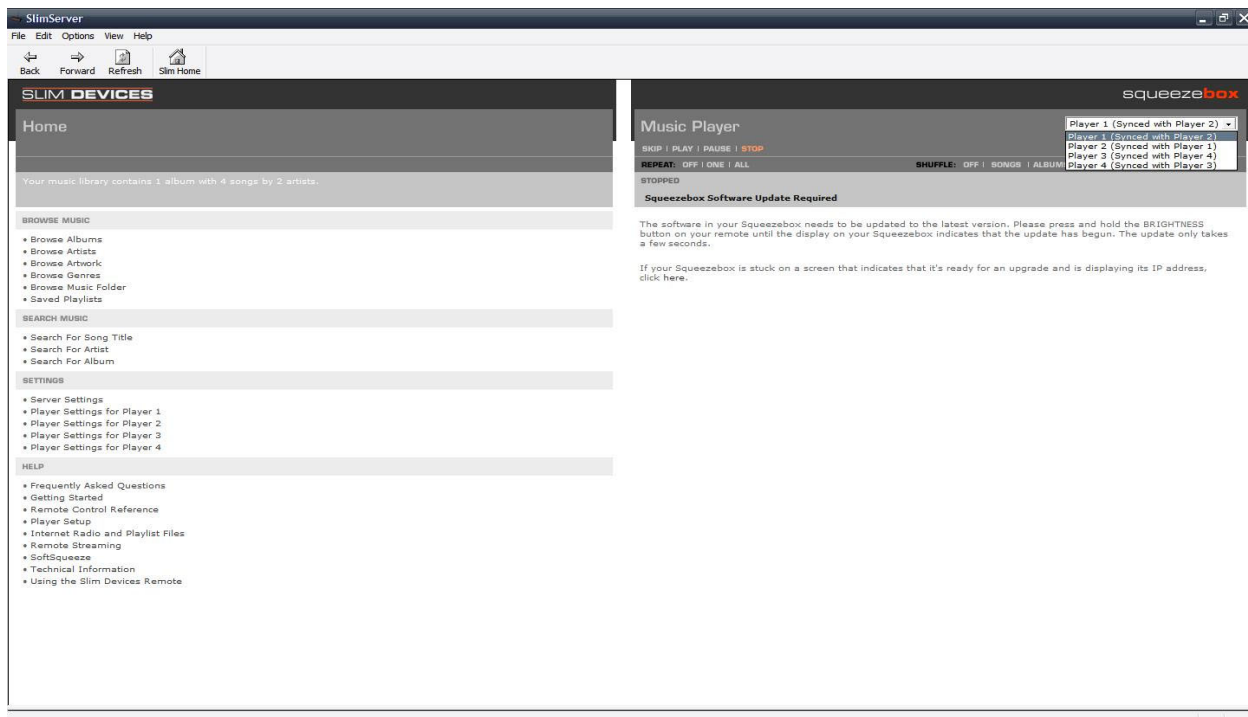
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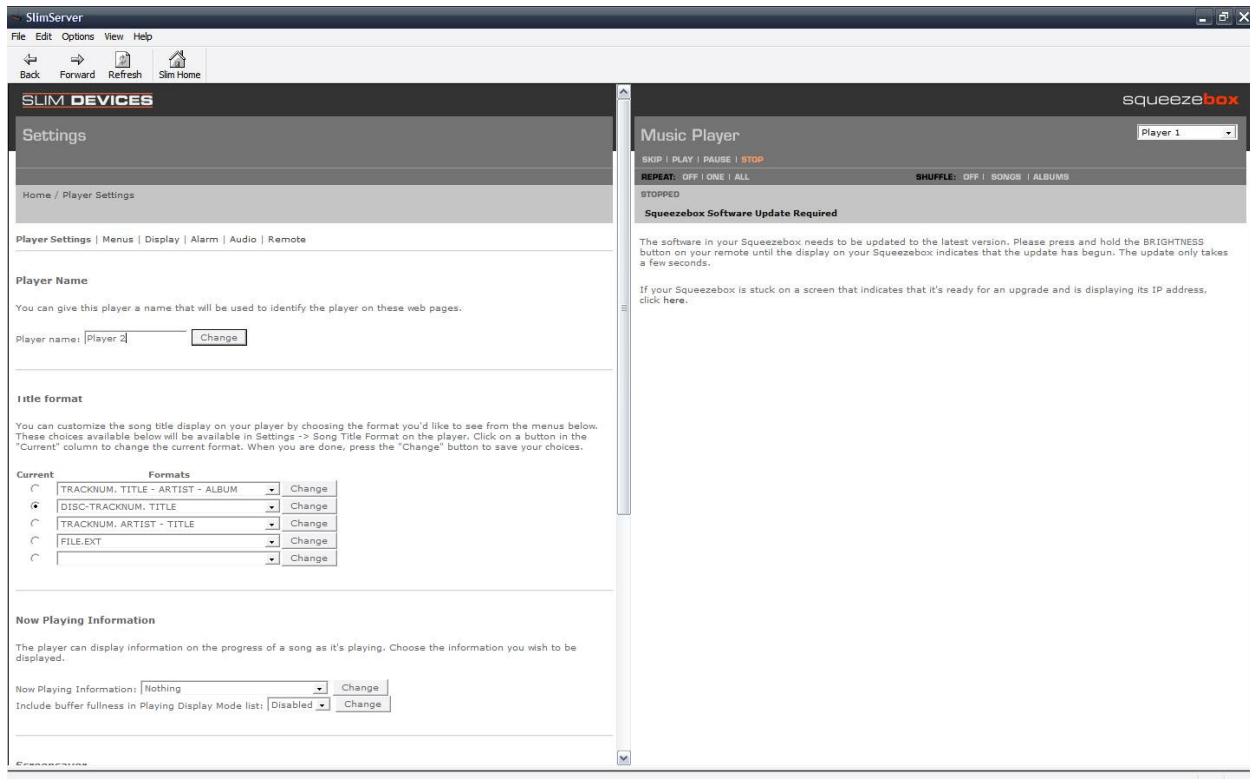


357. This version of the Slim Server allows the user to group Squeezeboxes, such as grouping Player 1 with Player 2 and Player 3 with Player 4.



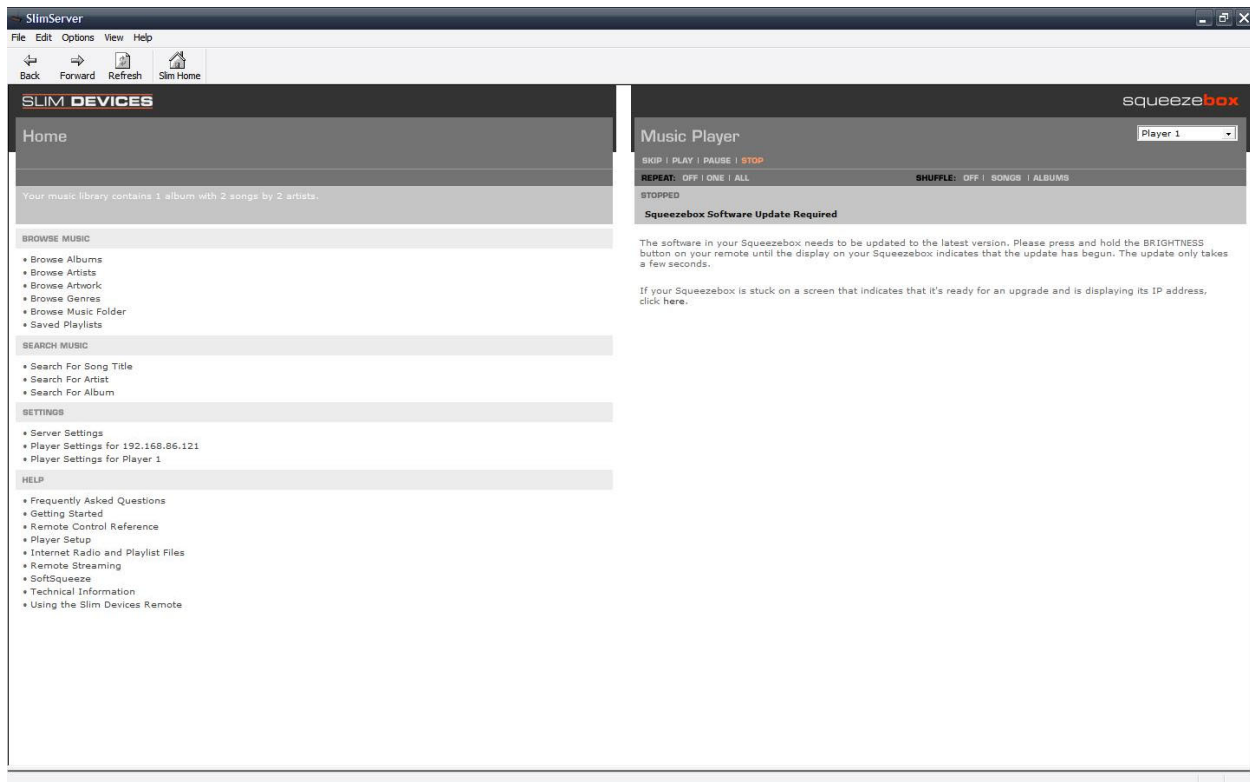
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358. The user of Slim Server may change the name and identifiers of the Squeezebox devices, which in turn changes the name of the grouped Squeezebox devices. The Squeezebox devices may be played to individually or as a group.<sup>4</sup>



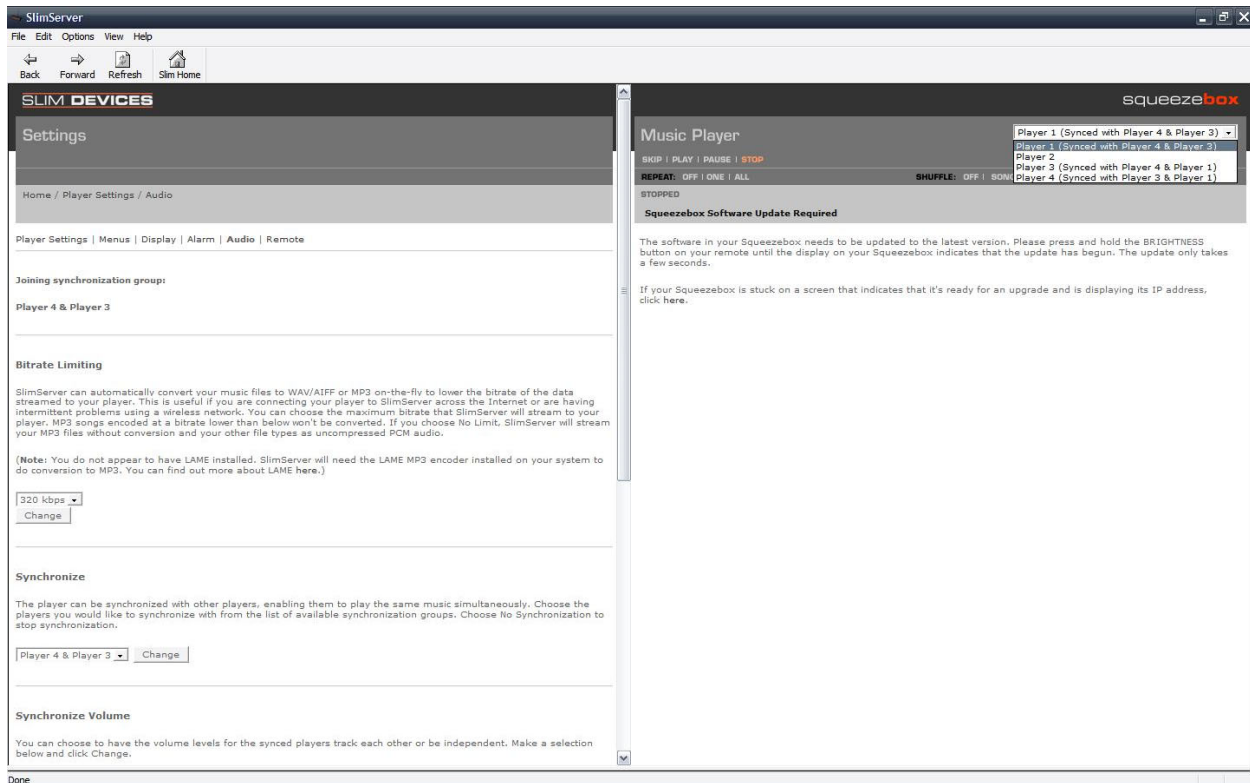
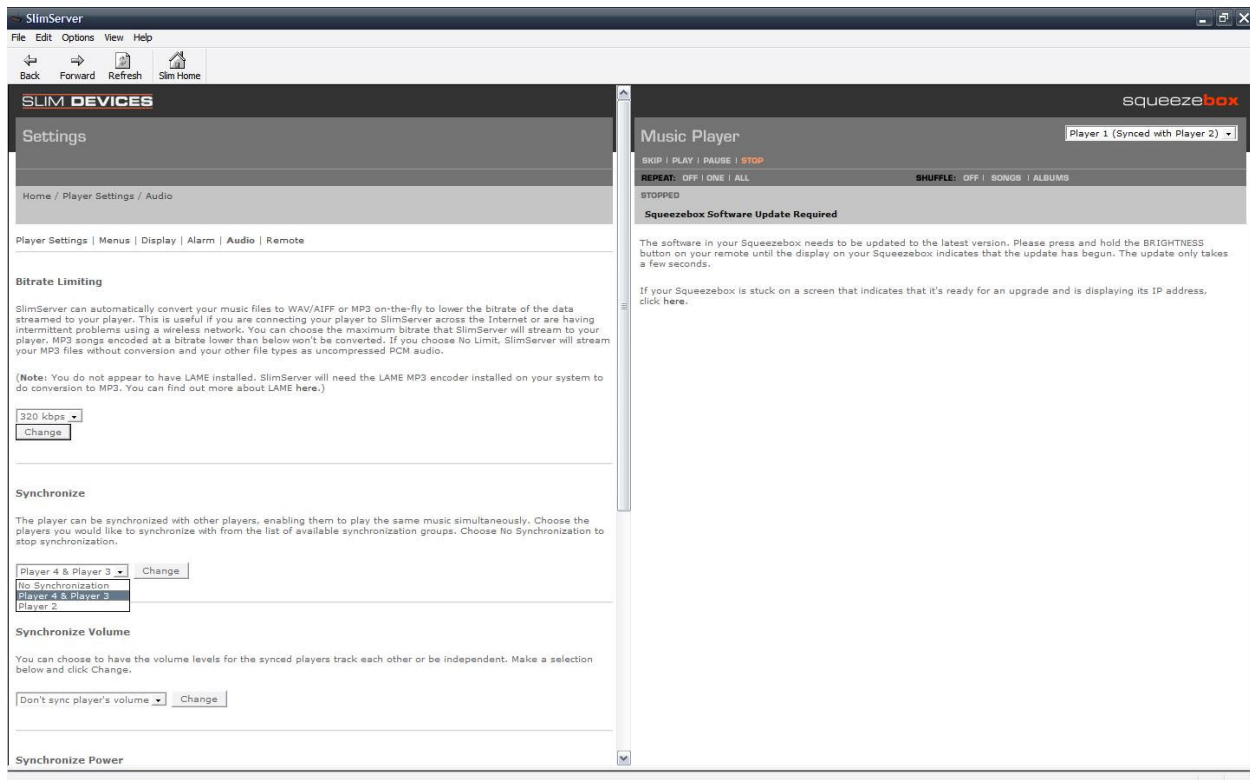
<sup>4</sup> At times I refer to Squeezebox or Softsqueeze devices, but as explained above, these are generally interchangeable as they show the same functionality. Softsqueeze runs on a computer whereas Squeezebox is a physical device with the same features and functionality. I do not intend reference to one to indicate exclusion of the other.

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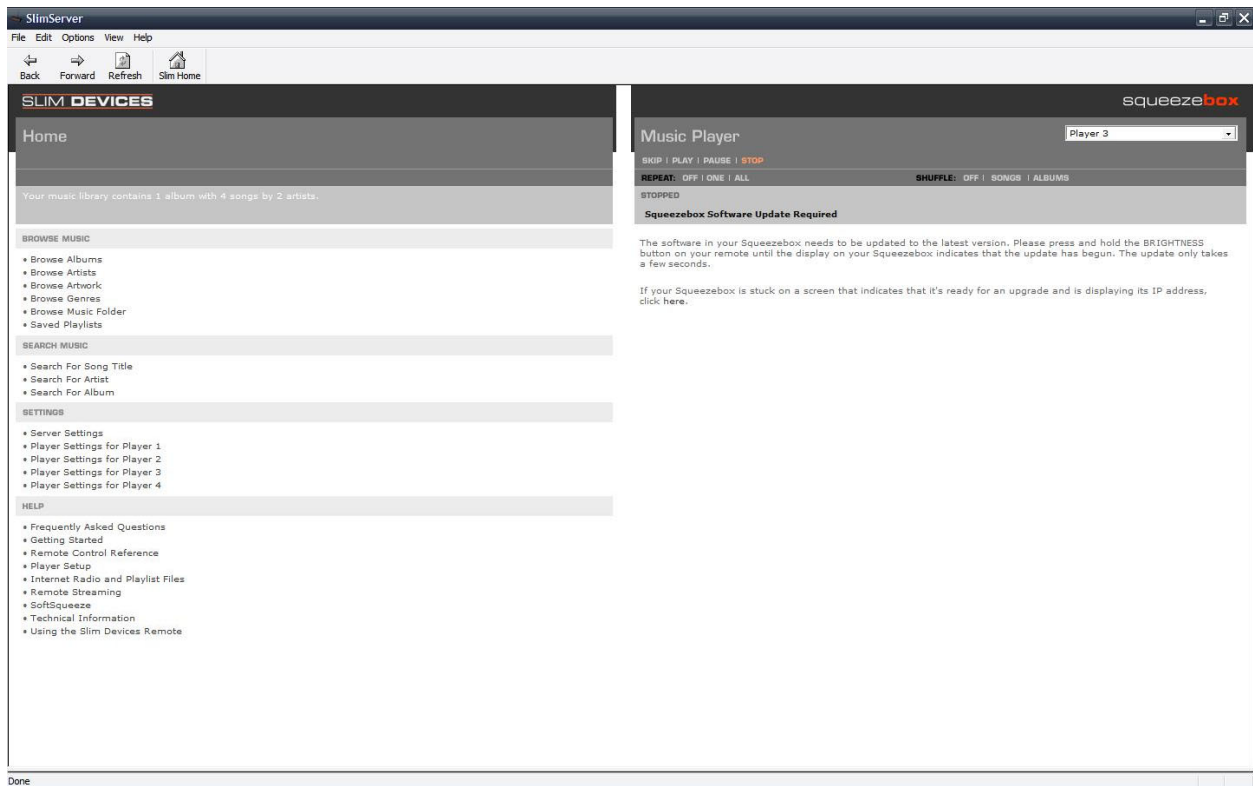
359. Slim Server allows a user to change the synchronization groups after they have been created and stored.

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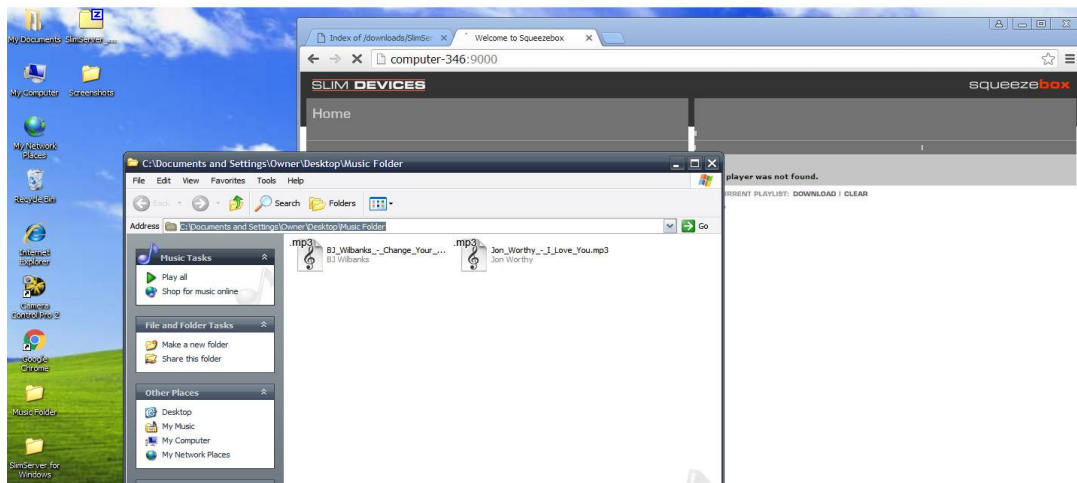


360. Slim Server also allows a Squeezebox to play media without being in a synchronization group, which corresponds to the claimed standalone mode.

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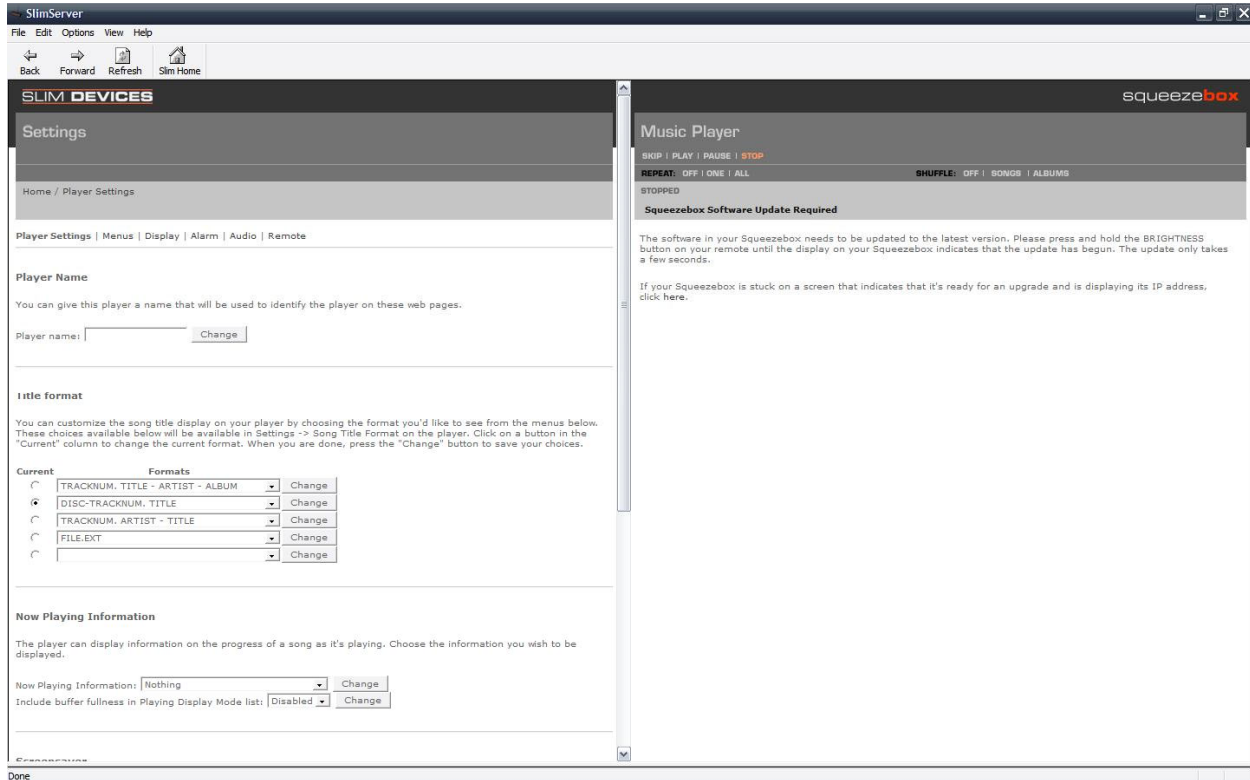


361. That media may be accessible to the SlimServer and organized and processed by the SlimServer software such that it can be delivered to one or more Squeezeboxes.

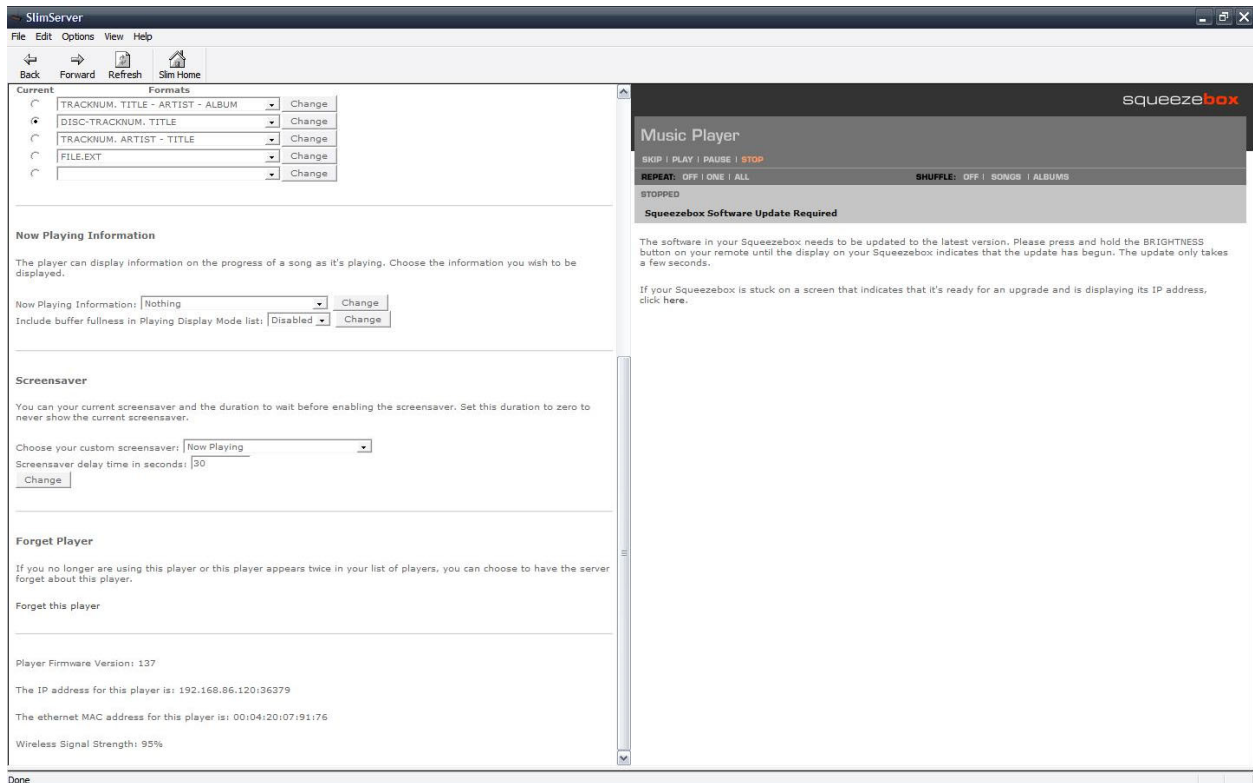
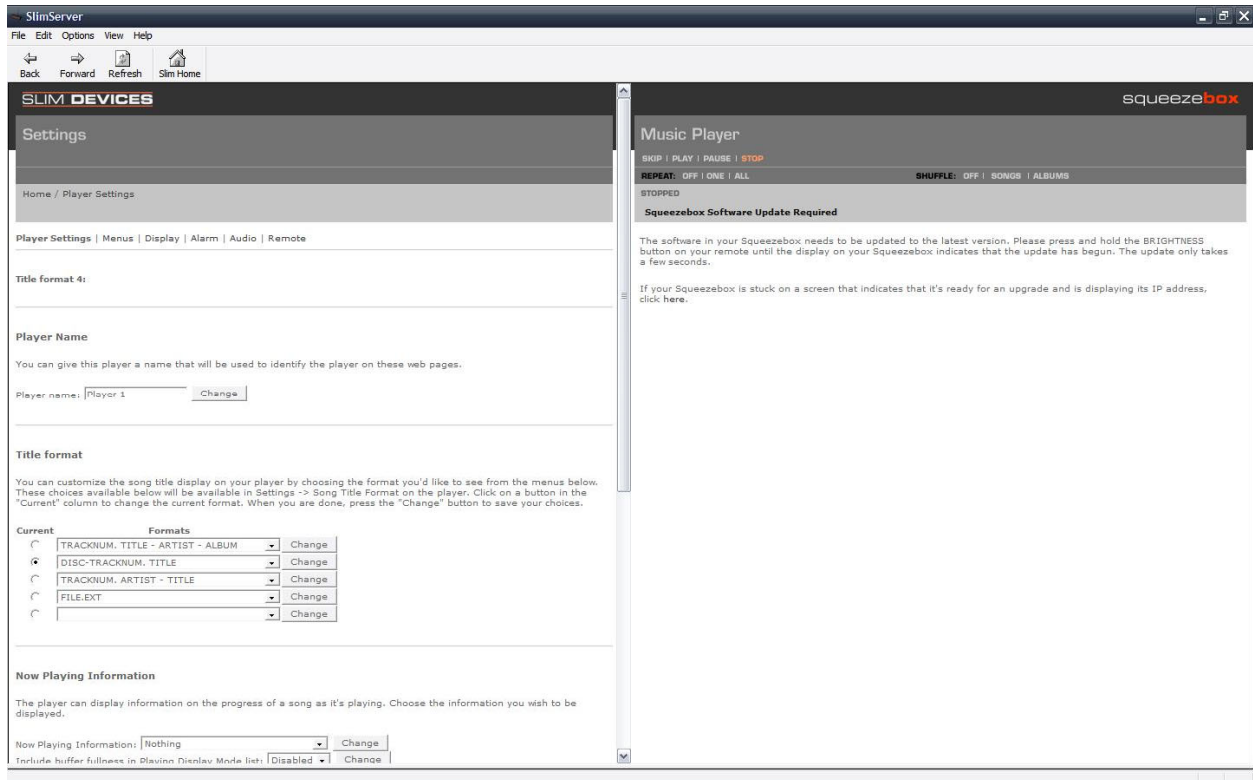


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362. Slim Server also allows a user to change the format in which that media appears on the Squeezebox.

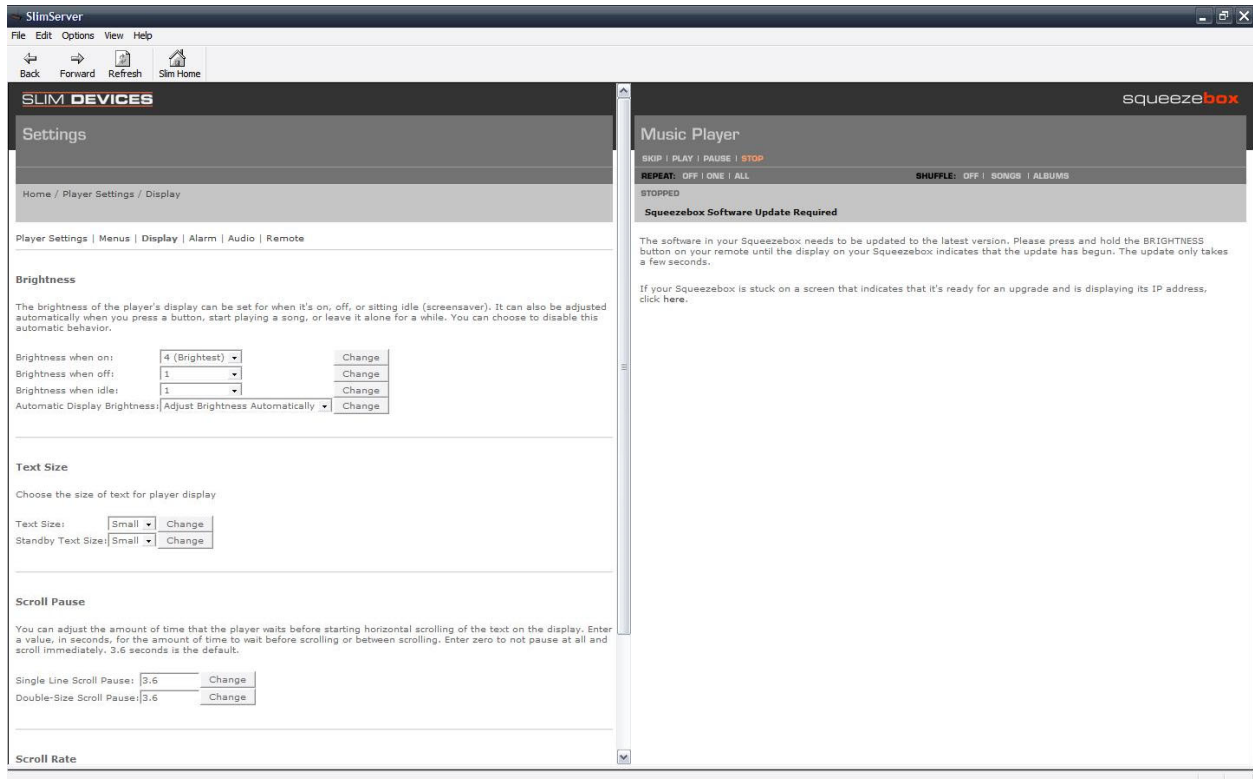
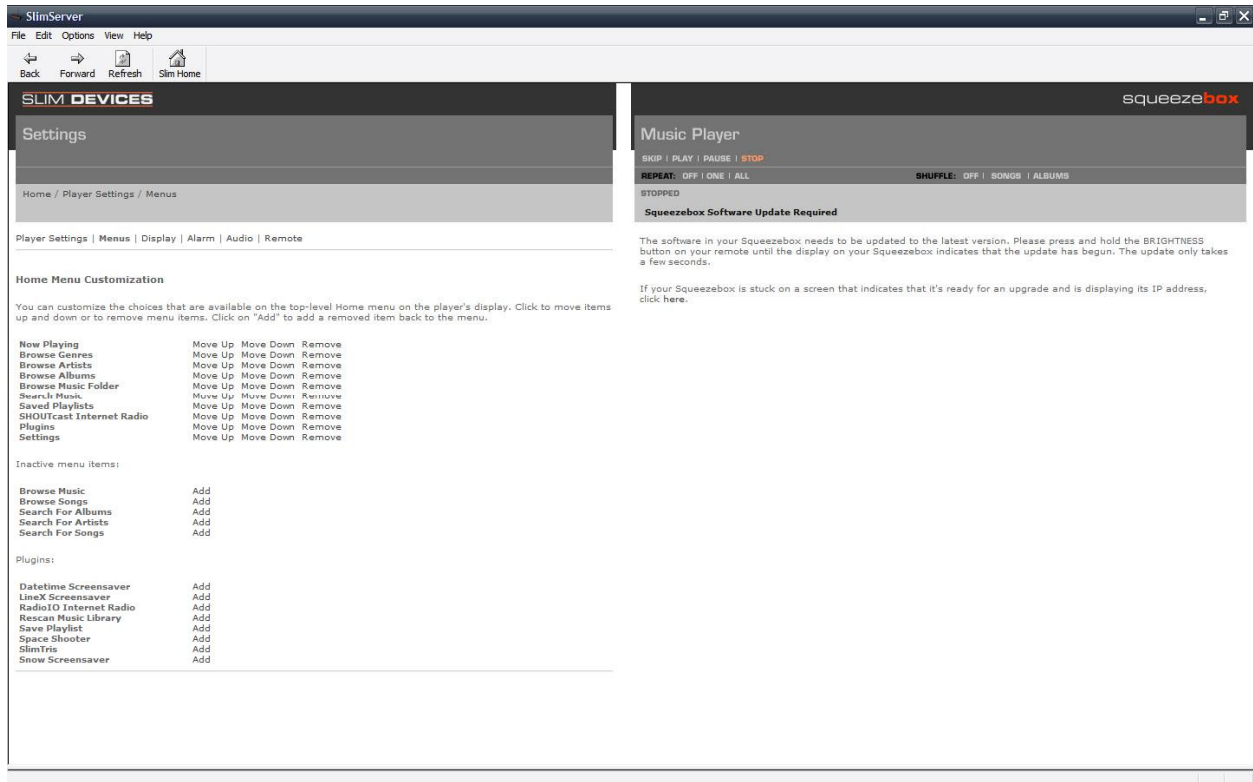


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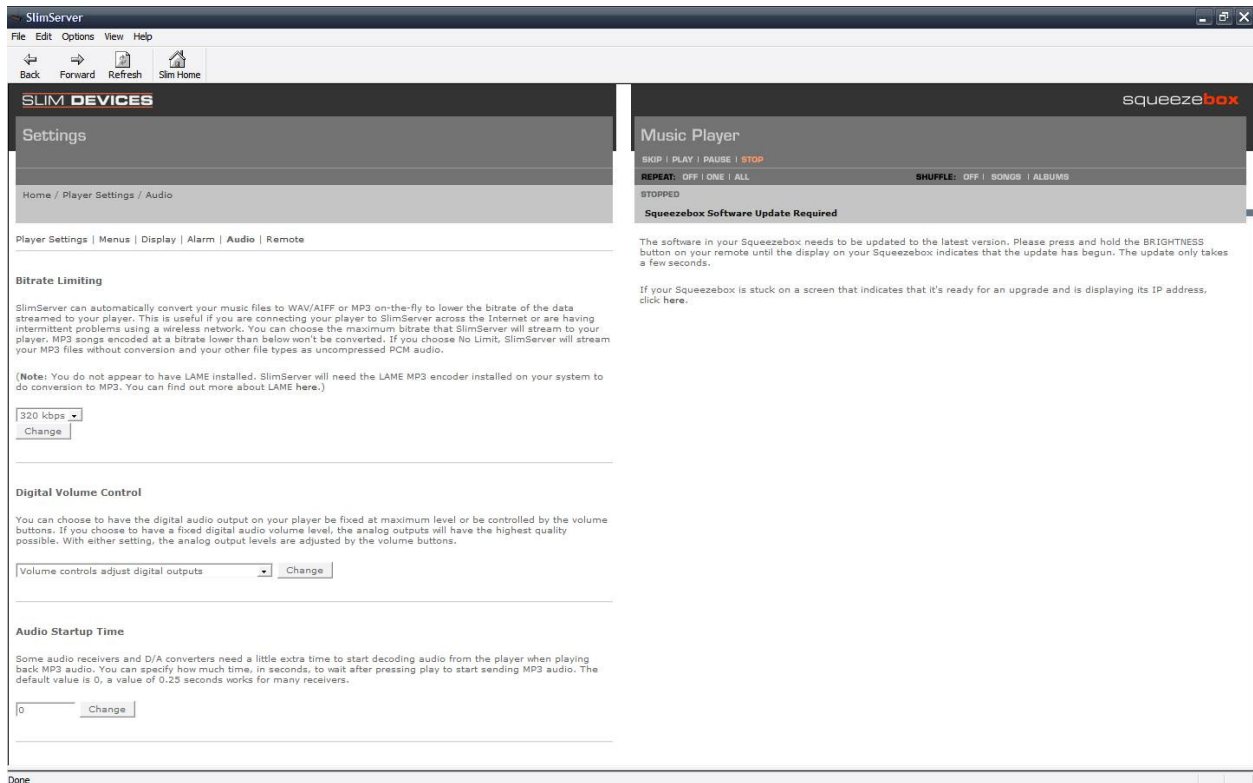
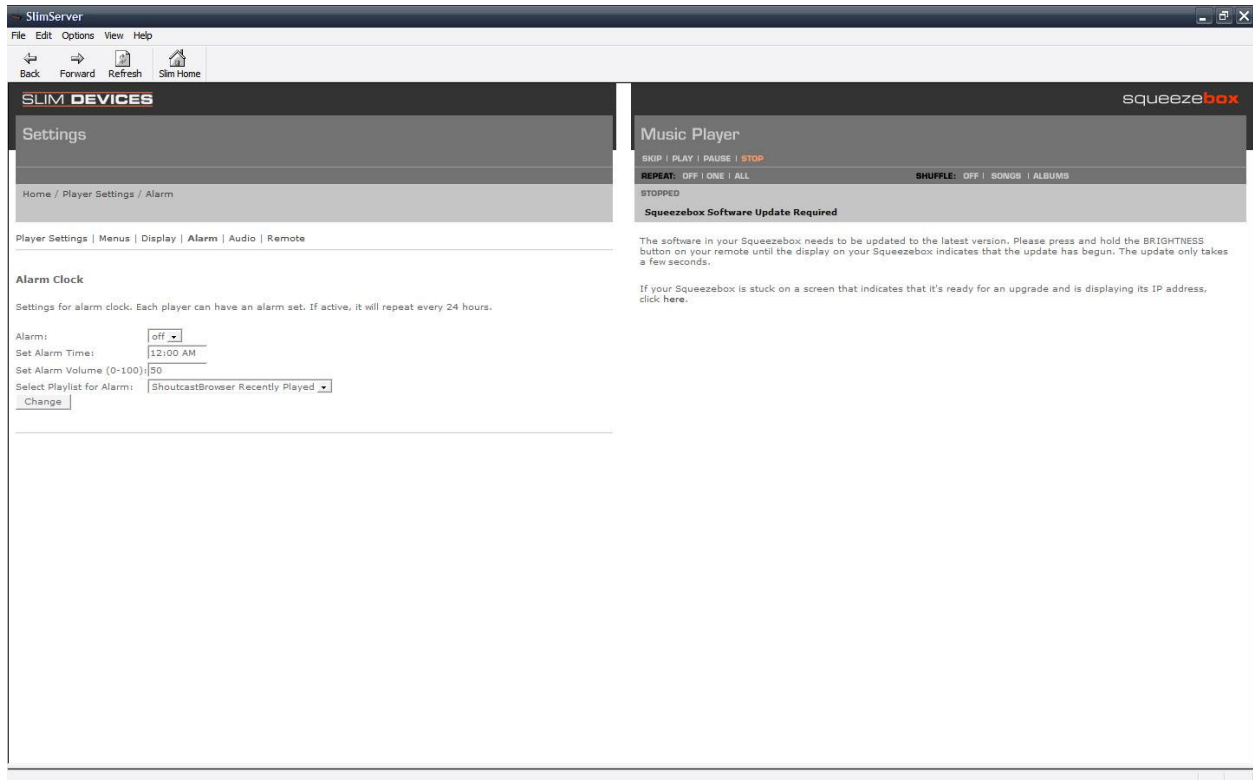


363. Menus and options on Squeezebox are customizable in the SlimServer software, and these configurations are stored in the Squeezebox devices.

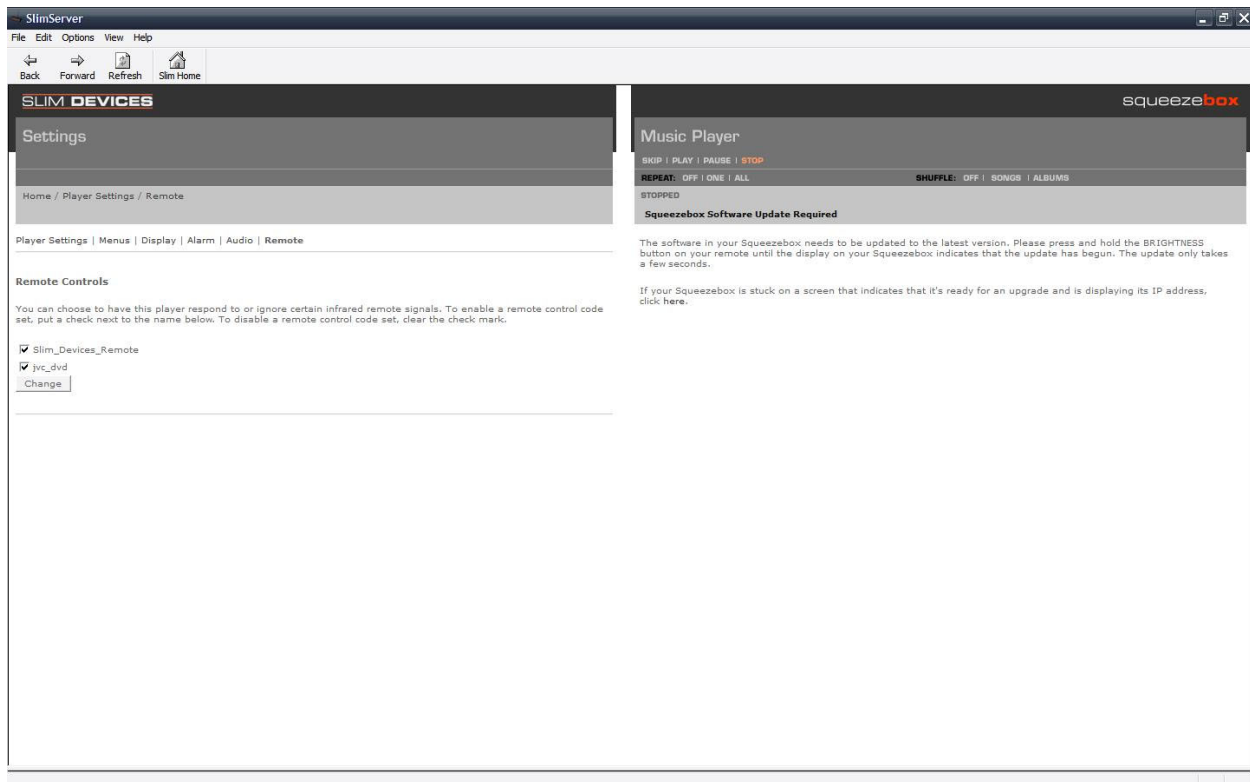
## Contains Highly Confidential AEO and Source Code Materials



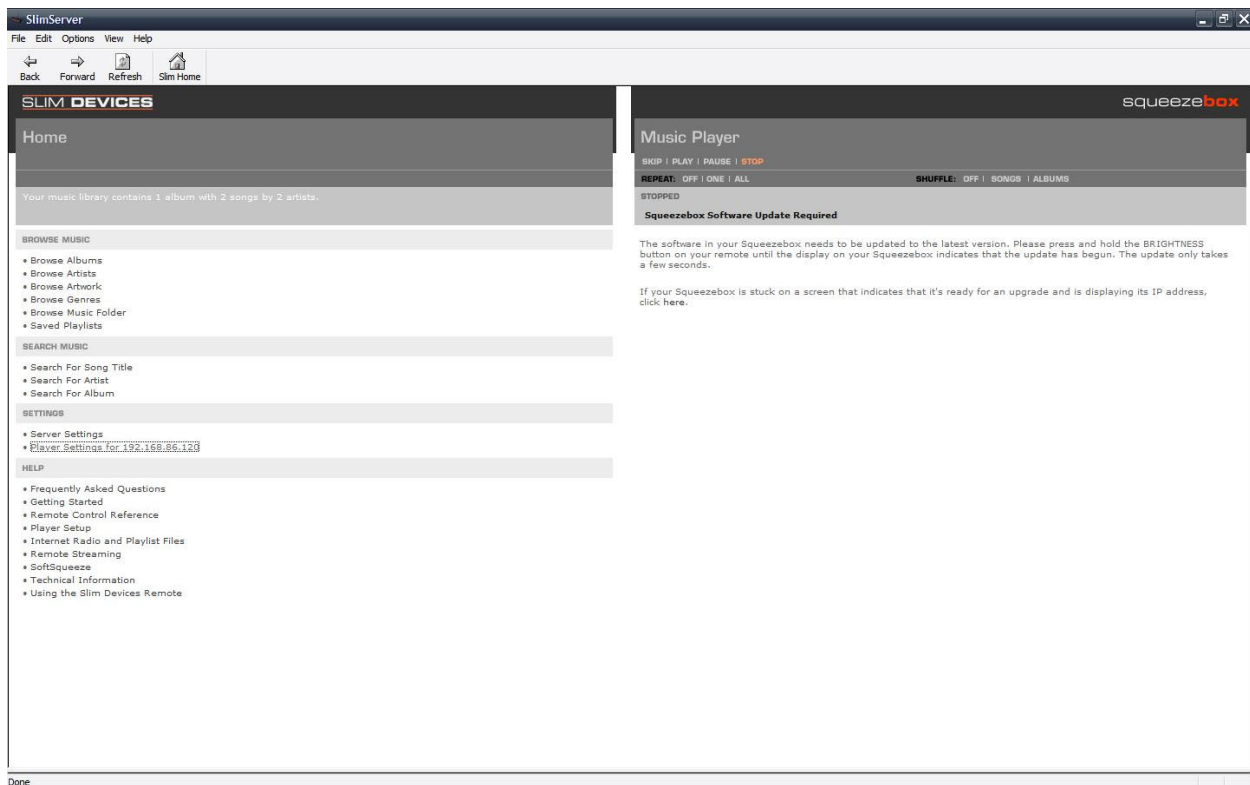
## Contains Highly Confidential AEO and Source Code Materials



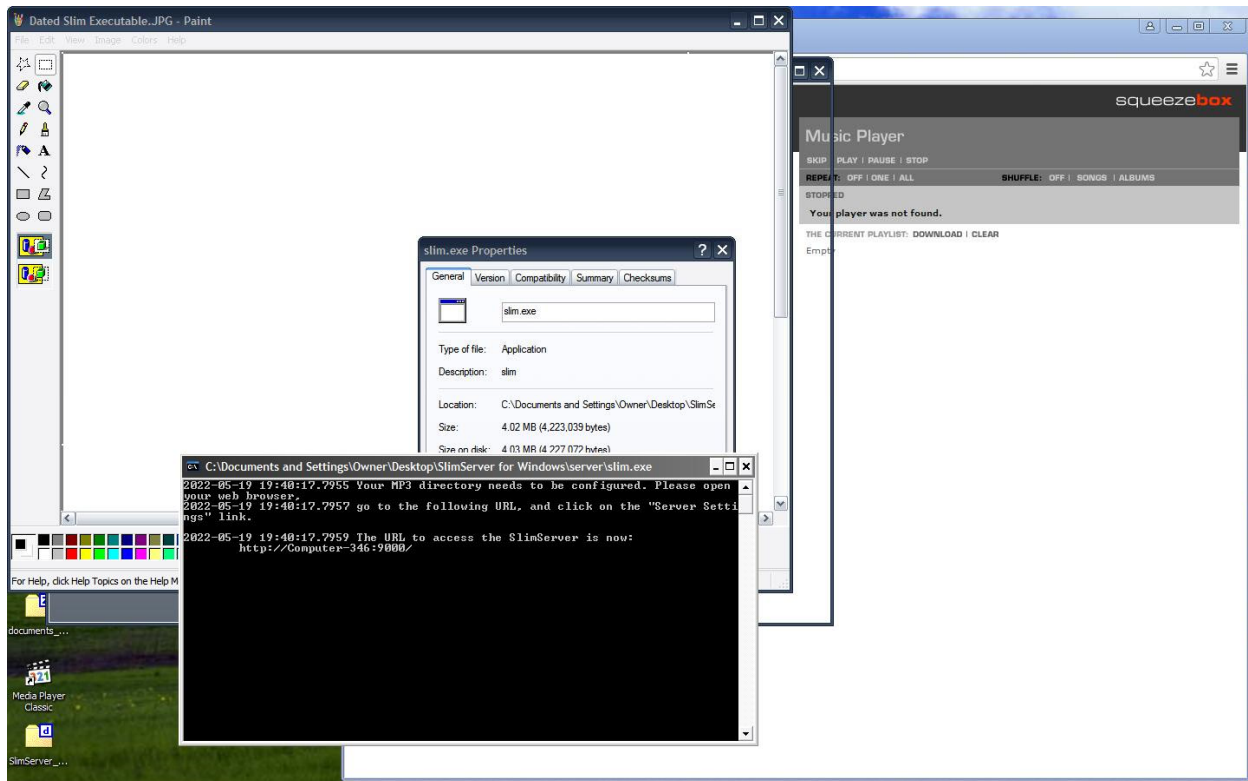
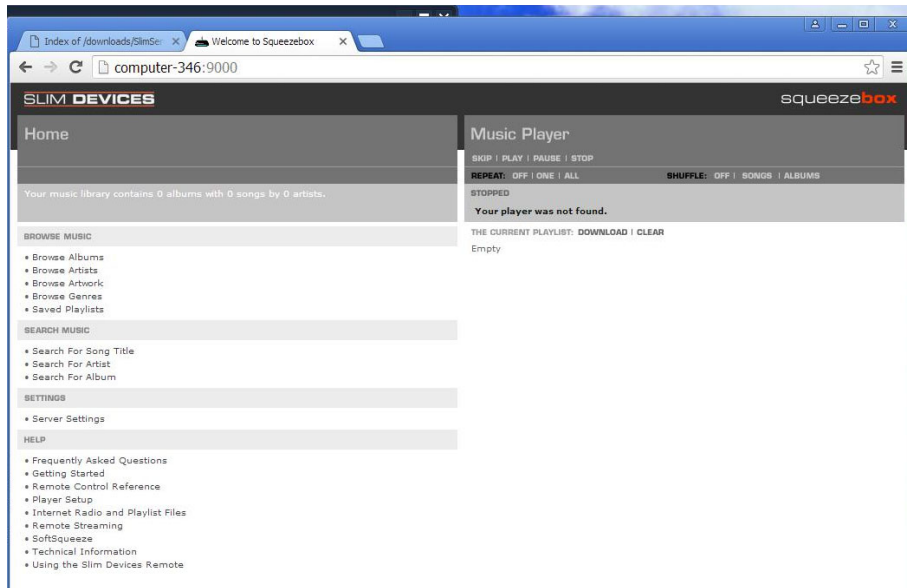
## Contains Highly Confidential AEO and Source Code Materials



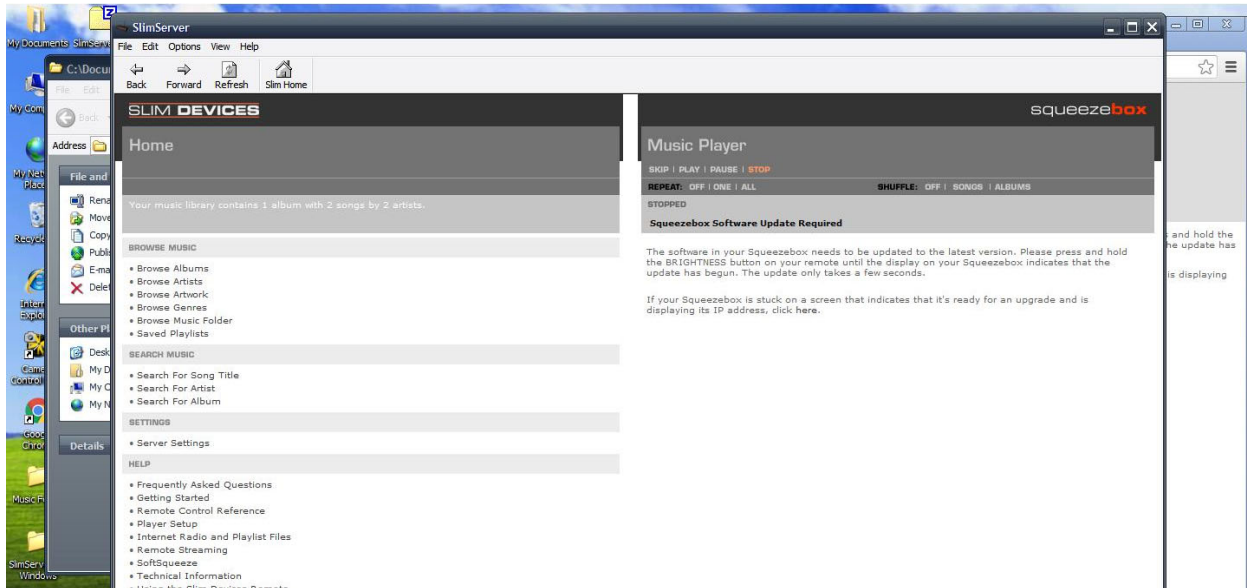
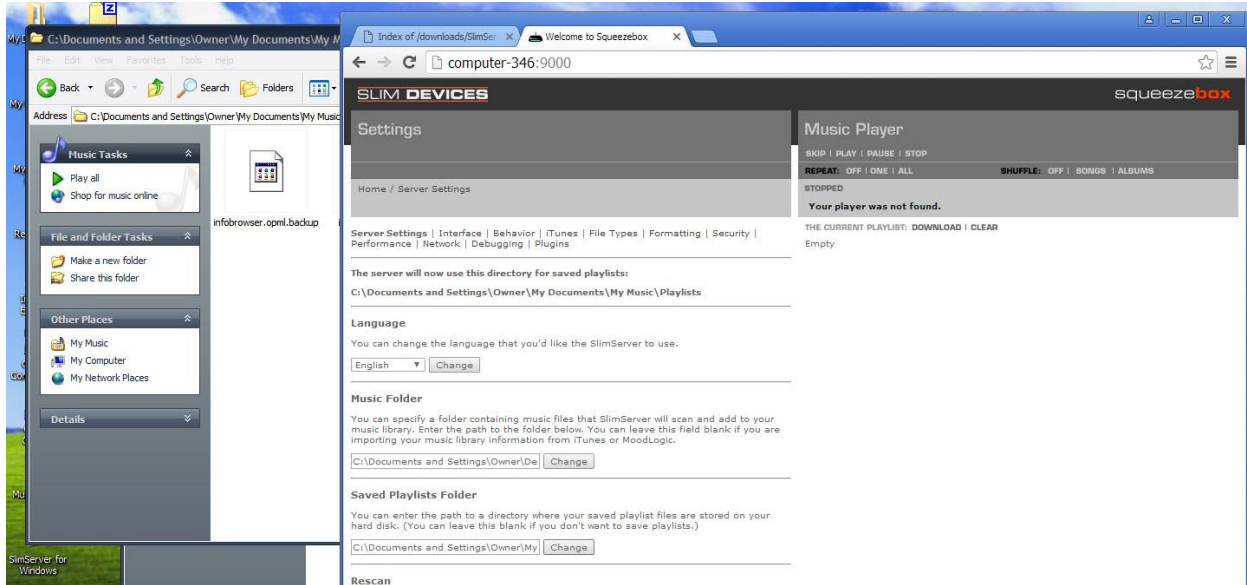
364. The user may name the Squeezebox something other than its IP address.



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365. As discussed above, SlimServer supports synchronizing multiple Squeezebox players so that they play the same audio.

#### How do I synchronize two Squeezeboxes so they play the same audio?

Navigate into the Player Settings area with the remote control. Choose Synchronize, then select the other player you want to synchronize with and press the RIGHT button. Both will play the same thing and you can control their synchronized playback from either remote. Go back to the same place and press RIGHT again to unsync.

You can also set up synchroniziation from the Player Settings page in the web interface.

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[http://<SLIMSERVER\\_ADDR>:9000/html/docs/faq.html?player=#setup-sync](http://<SLIMSERVER_ADDR>:9000/html/docs/faq.html?player=#setup-sync) → Home / Frequently Asked Questions → HTML/EN/faqquestions.html.

366. The source code confirms that Squeezebox discloses this claim limitation. The SlimServer server represents sync groups internally using the 'master', 'slaves', and 'syncgroupid' properties for a client (player). The properties are maintained as indexed array elements and accessed using accessor methods — master(), slaves(), and syncgroupid(). A sync group has one group member designated as master, with the remaining group members designated as slaves. For a master client, the 'slaves' property represents an array of slaves which are synced to it. A player is a master if its list of slaves is not empty. For a slave player, the 'master' property points to the master client. A player is a slave if its master property is defined. All members of a group share the same syncgroupid. A client is considered to be synced if it either has slaves or has a master. An unsynced client does not have either a master or slaves.

**Slim/Player/Client.pm (v5.3.1)**

```
=item
master() - type: client
    if we're synchronized, 'master' points to master client
=item
slaves() - type: clients
    if we're a master, this is an array of slaves which are synced to us
=item
syncgroupid() - type: uniqueid
    unique identifier for this sync group
```

Slim::Player::Client::master() comment, Slim/Player/Client.pm (v5.3.1), 297–301  
 Slim::Player::Client::slaves() comment, Slim/Player/Client.pm (v5.3.1), 303–307  
 Slim::Player::Client::syncgroupid() comment, Slim/Player/Client.pm (v5.3.1), 309–313

Slim::Player::Client::master(), Slim/Player/Client.pm (v5.3.1), 1195–1198

Slim::Player::Client::slaves(), Slim/Player/Client.pm (v5.3.1), 1199–1204

Slim::Player::Client::syncgroupid(), Slim/Player/Client.pm (v5.3.1), 1205–1208

Slim::Player::Sync::isMaster(), Slim/Player/Sync.pm (v5.3.1), 351–358

Slim::Player::Sync::master(), Slim/Player/Sync.pm (v5.3.1), 360–366

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Slim::Player::Sync::slaves(), Slim/Player/Sync.pm (v5.3.1), 368–373

Slim::Player::Sync::isSlave(), Slim/Player/Sync.pm (v5.3.1), 376–381

Slim::Player::Sync::isSynced(), Slim/Player/Sync.pm (v5.3.1), 388–391

367. When a player (slave) is synced with a master, that player shares the master's playlist.

#### **Slim/Player/Client.pm (v5.3.1)**

```
=item
playlist() - type: array
    playlist of songs (when synced, use the master's)
```

#### **Slim/Player/Playlist.pm**

```
sub playList {
    my ($client) = shift;

    $client = Slim::Player::Sync::masterOrSelf($client);

    return $client->playlist;
}
```

Slim::Player::Client::playlist() comment, Slim/Player/Client.pm (v5.3.1), 207–211

Slim::Player::Client::playlist(), Slim/Player/Client.pm (v5.3.1), 1136–1141

Slim::Player::Playlist::playlist(), Slim/Player/Playlist.pm (v5.3.1), 54–60

368. The SlimServer persists the membership of a sync group by storing the definition of the syncgroupid property for each group member into the SlimServer's preferences file. When a first player is synced with a second player, the first player is assigned the same syncgroupid as the second player's master. If the master does not already have a syncgroupid, a new one is generated first.

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**Slim/Player/Sync.pm (v5.3.1)**

```

sub saveSyncPrefs {

    my $client = shift;
    my $temp = shift;
    my $clientID = $client->id();
    if (isSynced($client)) {

        if (!defined($client->master->syncgroupid)) {
            $client->master->syncgroupid(int(rand 999999999));
        }

        my $masterID = $client->master->syncgroupid;
        # Save Status to Prefs file
        $::d_sync && msg("Saving $clientID as a slave to $masterID\n");
        Slim::Utils::Prefs::clientSet($client, 'syncgroupid', $masterID);
        Slim::Utils::Prefs::clientSet($client->master, 'syncgroupid', $masterID);

    }
    if ($temp) {
        $::d_sync && msg("Idling Sync for $clientID\n");
    } else {
        $client->syncgroupid(undef);
        Slim::Utils::Prefs::clientDelete($client, 'syncgroupid');
        $::d_sync && msg("Clearing Sync master for $clientID\n");
    }
}

```

Slim::Player::Sync::saveSyncPrefs(), Slim/Player/Sync.pm (v5.3.1), 169–194

369. A SlimServer can be instructed to synchronize a first player with a second player in a number of ways, such as by using the web interface, using the CLI, or by using the directional (“arrow”) buttons on the remote to change the synchronization settings. The following discussion focuses on using the remote buttons. The screenshots are for the SoftSqueeze player. The player sends an IR remote code using the SlimProto ‘IR’ command to SlimServer for processing.

**"IR "** (Note the two spaces to make it up to 4 characters.)

One of these packets is recieved for each IR code recieved by the player.

**Data Length:** Fixed at 10 bytes.

**Format:**

Time	4 bytes	Time since player startup in ticks (@1Khz)
Format	1 byte	Code Format (ignored by the server for now - Code represents type of IR code - NEC, JVC or Sony)
NoBits	1 byte	Length of IR Code (ignored by the server for now - 16 bits for JVC, 32 bits for NEC?)
IRCode	4 bytes	the IR Code itself (upto 32 bits)

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[http://<SLIMSERVER\\_ADDR>:9000/html/docs/slimproto.html](http://<SLIMSERVER_ADDR>:9000/html/docs/slimproto.html)  
HTML/EN/html/docs/slimproto.html

370. SlimServer receives IR remote codes and enqueues them for processing.

Slim::Networking::Slimproto::process\_slimproto\_frame(),  
Slim/Networking/Slimproto.pm, at 247–486 at 357–371

371. The enqueued IR remote codes are processed as a ‘button’ command. Button actions are looked up in the function map for the current mode.

Slim::Hardware::IR::idle(), Slim/Hardware/IR.pm, 39–43 at 41  
Slim::Control::Command::execute(), Slim/Control/Command.pm, 24–713 at 686  
Slim::Hardware::IR::processIR(), Slim/Hardware/IR.pm, 334–393 at 388  
Slim::Hardware::IR::processCode(), Slim/Hardware/IR.pm, 552–571 at 569  
Slim::Control::Command::execute(), Slim/Control/Command.pm, 24–713 at 683  
Slim::Hardware::IR::executeButton(), Slim/Hardware/IR.pm, 510–550

372. In particular, the IR buttons allow navigation through the Settings to a ‘Synchronize’ menu to allow an unsynced player to be synchronized with a synchronization group. For example, the directional keys can be used to navigate to the ‘Synchronize’ menu.



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373. The up and down buttons allow selection of synchronization groups. The right button causes the current player to sync with the selected synchronization group. In this example, pressing the right button causes the server to sync player1 with player2 and player3. In the Synchronize mode, the right button causes the client to be synchronized with the selected synchronization group if not already synchronized.

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**Slim/Buttons/Synchronize.pm (v5.3.1)**

```

'right' => sub {
    my $client = shift;

    my $selectedClient = $client->syncSelections($client->syncSelection);

    my @oldlines = Slim::Display::Display::curLines($client);

    if (Slim::Player::Sync::isSyncedWith($client, $selectedClient) || ($client eq $selectedClient))
    {
        Slim::Player::Sync::unsync($client);
    } else {
        Slim::Player::Sync::sync($client, $selectedClient);
    }
    $client->pushLeft("\@oldlines, [Slim::Display::Display::curLines($client)]);
},

```

\$Slim::Buttons::Synchronize::functions{'right'}, Slim/Buttons/Synchronize.pm, 34–47 at 44

Slim::Player::Sync::sync(), Slim/Player/Sync.pm, 132–167

374. After the synchronization, SlimServer stores the updated syncgroupid settings to the preferences file.

**Slim/Player/Sync.pm (v5.3.1)**

```

sub saveSyncPrefs {

    my $client = shift;
    my $temp = shift;
    my $clientID = $client->id();
    if (isSynced($client)) {

        if (!defined($client->master->syncgroupid)) {
            $client->master->syncgroupid(int(rand 999999999));
        }

        my $masterID = $client->master->syncgroupid;
        # Save Status to Prefs file
        $::d_sync && msg("Saving $clientID as a slave to $masterID\n");
        Slim::Utils::Prefs::clientSet($client, 'syncgroupid', $masterID);
        Slim::Utils::Prefs::clientSet($client->master, 'syncgroupid', $masterID);

    }
    if ($temp) {
        $::d_sync && msg("Idling Sync for $clientID\n");
    } else {
        $client->syncgroupid(undef);
        Slim::Utils::Prefs::clientDelete($client, 'syncgroupid');
        $::d_sync && msg("Clearing Sync master for $clientID\n");
    }
}

```

Slim::Player::Sync::sync(), Slim/Player/Sync.pm, 132–167 at 163

Slim::Player::Sync::saveSyncPrefs(), Slim/Player/Sync.pm, 169–194 at 174–184

375. In this example, the preferences file identifies player1, player2, and player3 with

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the same syncgroupid (450486363).

#### slimserver.conf

```
0f:59:51:64:dc:d7-playername = player2
...
0f:59:51:64:dc:d7-syncgroupid = 450486363
...
51:93:a5:ad:53:20-playername = player3
...
51:93:a5:ad:53:20-syncgroupid = 450486363
...
bc:39:f3:c4:1e:29-playername = player1
...
bc:39:f3:c4:1e:29-syncgroupid = 450486363
```

376. After performing the synchronization action and saving preferences, the server sends updated screen lines to the server indicating that the right-button action has been changed to unsync with player2 and player3. The updated message encoded into an update that pushes the old pre-sync message lines (@oldlines) off the screen to the left, replaced with new screen lines.

#### Slim/Buttons/Synchronize.pm (v5.3.1)

```
'right' => sub {
    my $client = shift;

    my $selectedClient = $client->syncSelections($client->syncSelection);

    my @oldlines = Slim::Display::Display::curLines($client);

    if (Slim::Player::Sync::isSyncedWith($client, $selectedClient) || ($client eq $selectedClient))
    {
        Slim::Player::Sync::unsync($client);
    } else {
        Slim::Player::Sync::sync($client, $selectedClient);
    }
    $client->pushLeft("\@oldlines, [Slim::Display::Display::curLines($client)]);
},
```

377. Because the player is now synced, the updated screen lines change from the localized SYNC\_WITH message to the localized UNSYNC\_WITH message.

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**Slim/Buttons/Synchronize.pm (v5.3.1)**

```

sub lines {
    my $client=shift;
    my $line1;
    my $line2;
    my $symbol = undef;

    loadList($client);

    if (scalar @{$client->syncSelections} < 1) {
        warn "Can't sync without somebody to sync with!";
        Slim::Buttons::Common::popMode($client);
    } else {
        # get the currently selected client
        my $selectedClient = $client->syncSelections($client->syncSelection);

        if (Slim::Player::Sync::isSyncedWith($client, $selectedClient) || $selectedClient eq
$client) {
            $line1 = Slim::Utils::Strings::string('UNSYNC_WITH');
        } else {
            $line1 = Slim::Utils::Strings::string('SYNC_WITH');
        }
        $line2 = buddies($client, $selectedClient);
    }
    return ($line1, $line2, undef, Slim::Display::Display::symbol('rightarrow'));
}

```

\$Slim::Buttons::Synchronize::functions{'right'}, Slim/Buttons/Synchronize.pm, 34–47 at 46

Slim::Display::Display::curLines(), Slim/Display/Display.pm, 104–120 at 115

Slim::Buttons::Synchronize::lines(), Slim/Buttons/Synchronize.pm, 67–90 at 79–87

UNSYNC\_WITH localization, strings.txt, 6531–6540

378. The old and new screen lines are rendered into start and end graphic (bit), which are concatenated into one large screen. SlimServer then issues a series of Slimproto frame buffer messages ('grfd' messages for SqueezeboxG devices) to the player over TCP, starting with a screen that shows only the start screen lines and then shifting left in successive messages until the final message shows only the end screen lines.

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\$Slim::Buttons::Synchronize::functions{'right'}, Slim/Buttons/Synchronize.pm, 34–47 at 46  
 Slim::Player::SqueezeboxG::pushLeft(), Slim/Player/SqueezeboxG.pm, 401–414 at 413  
 Slim::Player::SqueezeboxG::pushUpdate(), Slim/Player/SqueezeboxG.pm, 447–464 at 459  
 Slim::Player::SqueezeboxG::drawFrameBuf(), Slim/Player/SqueezeboxG.pm, 368–382 at 380  
 Slim::Player::Squeezebox::sendFrame(), Slim/Player/Squeezebox.pm, 514–533

379. The ‘grfd’ message is not documented in “The SlimProto TCP Protocol” page that is included with the v5.3.1 distribution, but it is mentioned in the “SlimProtoTCP protocol” page on the Squeezebox wiki as being used to draw graphics for SqueezeboxG. *E.g.*, [https://wiki.slimdevices.com/index.php/SlimProtoTCPProtocol.html#Command\\_.22grfd.22](https://wiki.slimdevices.com/index.php/SlimProtoTCPProtocol.html#Command_.22grfd.22).

380. As discussed above, for example, a network device may comprise a SlimServer connected to Squeezeboxes or Softsqueezes over a data network (Ethernet or Wi-Fi) and it may provide an indication to the Squeezebox or Softsqueeze players that it has been added to a synchronization group comprising one or more other Squeezebox or Softsqueeze players, including a graphical indication displayed on those players. When media is played to the synchronization group, the players—depending on their configuration as discussed further below—within that group will respond and play back music synchronously.

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(viii) *Limitation 1.7: “(ii) receiving, from the network device over the data network, a second indication that the first zone player has been added to a second zone scene comprising a second predefined grouping of zone players including at least the first zone player and a third zone player that are to be configured for synchronous playback of media when the second zone scene is invoked, wherein the second zone player is different than the third zone player;”*

383. In my opinion, Squeezebox discloses or renders obvious this claim limitation.

384. I incorporate by reference my discussion of limitation 1.6 herein, which discloses receiving from a network device an indication that the zone player has been added to a zone scene comprising a predefined grouping of zone players that are to be configured for synchronous playback of media when the zone scene is invoked. Limitation 1.7 adds the limitation that the first zone player is a member of two different “zone scenes.”

385. The SlimServer configuration, including the definitions of the sync groups, is

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stored into a preferences file. However, a single player may be defined in separate sync groups on different SlimServer configurations, persisted to different preferences files. As one example, a player may be used with different servers, which define different sync groups and persist to different preferences files. One example (v6.2.1) is using a player both with a local SlimServer and with the SqueezeNetwork. As another example, a player may be used with different invocations of the same server. Each invocation uses a different preference file, specified on the command line using the '--prefsfile' option.

**How do I synchronize two Squeezeboxes so they play the same audio?**

Navigate into the Player Settings area with the remote control. Choose Synchronize, then select the other player you want to synchronize with and press the RIGHT button. Both will play the same thing and you can control their synchronized playback from either remote. Go back to the same place and press RIGHT again to unsync.

You can also set up synchroniziation from the Player Settings page in the web interface.

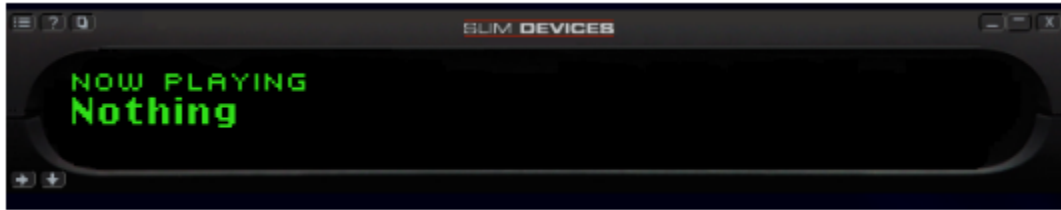
[http://<SLIMSERVER\\_ADDR>:9000/html/docs/faq.html?player=#setup-preferencefile](http://<SLIMSERVER_ADDR>:9000/html/docs/faq.html?player=#setup-preferencefile) →  
HTML/EN/faqquestions.html →  
Home / Frequently Asked Questions

386. Depending on configuration, the Squeezebox/SlimServer system can separate sync group definition from active sync group participation with respect to powered-off players.

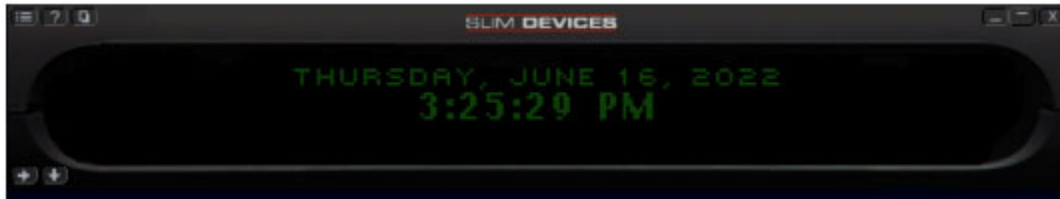
387. A Squeezebox player, including SoftSqueeze, can be commanded by SlimServer to power on or off. The “power off” status does not reflect the player being fully powered off (at least for SoftSqueeze). Instead, the player enters a dormant state and can be commanded to power back on.

388. For example, a player that is powered on but in the STOP state displays an active screen (e.g., Now Playing) at normal brightness:

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389. When powered off, the player displays the date and time at a dimmed brightness.



390. In the Squeezebox/SlimServer system, a player may be configured to power on/off either independently of its sync group or together with all the other players in its sync group.

**Synchronize Power**

You can choose to have this player turn off on its own, or turn off as a group with all other players in the group. Make a selection below and click Change.

[http://<slimserver\\_addr>:9000/setup.html?page=audio&player=<PLAYER>&playerid=<PLAYER\\_ID>](http://<slimserver_addr>:9000/setup.html?page=audio&player=<PLAYER>&playerid=<PLAYER_ID>)

Home / Player Settings / Audio

SETUP\_SYNC\_POWER\_DESC, strings.txt (v5.3.1), 1518–1523

391. A powered-off player is temporarily unsynced but still defined to be part of the persistent sync group. Because a player can be configured to turn on/off independently of its sync group, a persistently defined sync group may include players that are powered off and not actively participating in a sync group. A powered-off player is "temporarily" unsynced from its sync group. See, e.g. (v5.3.1): Error rendering macro 'code': Invalid value specified for parameter 'com.atlassian.confluence.ext.code.render. InvalidValueException:

Slim::Web::Setup::initSetupConfig(), Slim/Web/Setup.pm (v5.3.1), 103–2118 at 951–972

```

sub setMode {
    my $client = shift;
    $client->lines(\\&lines);
    my $sync = Slim::Utils::Prefs::clientGet($client, 'syncPower');
    if (defined $sync && $sync == 0) {
        $::d_sync && Slim::Utils::Misc::msg("Temporary Unsync ".$client->id()."\\n");
        Slim::Player::Sync::unsync($client, 1);
    }

    if (Slim::Player::Source::playmode($client) eq 'play' && Slim::Player::Playlist::song($client)) {
        if (Slim::Music::Info::isRemoteURL(Slim::Player::Playlist::song($client))) {
            Slim::Control::Command::execute($client, ["stop"]);
        } else {
            Slim::Control::Command::execute($client, ["pause", 1]);
        }
    }

    # switch to power off mode
    # use our last saved brightness
    $client->brightness(Slim::Utils::Prefs::clientGet($client, "powerOffBrightness"));
    $client->update();
}

```

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392. When a non-master player is temporarily unsynced from its group, it is removed from the master/slave data structures in dynamic memory. The player is removed from the master's list, and the player's 'master' property is set to undefined.

**Slim/Player/Sync.pm (v5.3.1)**

```

    } elsif (isSlave($client)) {
        # if we're a slave, remove us from the master's list
        my $i = 0;
        foreach my $c (@{$client->master()->slaves}) {
            if ($c->id() eq $client->id()) {
                splice @{$client->master->slaves}, $i, 1;
                last;
            }
            $i++;
        }

        # and copy the playlist to the now freed slave
        my $master = $client->master;
        Slim::Player::Playlist::copyPlaylist($client, $master);

        $client->master(undef);
    }

```

Slim::Player::Sync::unsync(), Slim/Player/Sync.pm (v5.3.1), 62–130 at 105–121

393. However, the temporary unsync is not recorded to the preferences file. The saveSyncPrefs() method is invoked with 1 for the \$temp argument, which causes its syncgroupid to be retained ("Idling Sync") rather than deleted.

**Slim/Player/Sync.pm (v5.3.1)**

```

    # when we unsync, we stop, but save settings first if we're doing at temporary unsync.
    if ($temp) {
        saveSyncPrefs($client, defined $temp);
        Slim::Control::Command::execute($client, ["stop"]);
    } else {
        Slim::Control::Command::execute($client, ["stop"]);
        saveSyncPrefs($client, defined $temp);
    }

```

Slim::Player::Sync::unsync(), Slim/Player/Sync.pm (v5.3.1), 62–130 at 122–129

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#### Slim/Player/Sync.pm

```

    if ($temp) {
        $::d_sync && msg("Idling Sync for $clientID\n");
    } else {
        $client->syncgroupid(undef);
        Slim::Utils::Prefs::clientDelete($client, 'syncgroupid');
        $::d_sync && msg("Clearing Sync master for $clientID\n");
    }

```

Slim::Player::Sync::saveSyncPrefs(), Slim/Player/Sync.pm (v5.3.1), 169–194 at 187–193

394. When a player is powered on, it is restored to its sync group.

#### Slim/Player/Player.pm (v5.3.1)

```

#check if there is a sync group to restore
Slim::Player::Sync::restoreSync($client);

```

Slim::Player::Player::power(), Slim/Player/Player.pm (v5.3.1), 203–247 at 230–231

#### Slim/Player/Sync.pm (v5.3.1)

```

# Restore Sync Operation
sub restoreSync {
    my $client = shift;
    my $masterID = (Slim::Utils::Prefs::clientGet($client, 'syncgroupid'));
    if ($masterID && $client->power()) {
        my @players = Slim::Player::Client::clients();
        foreach my $other (@players) {
            next if ($other eq $client);
            next if (!$other->power());
            my $othermasterID = Slim::Utils::Prefs::clientGet($other, 'syncgroupid');
            if ($othermasterID && ($othermasterID eq $masterID)) {
                $client->syncgroupid($masterID);
                $other->syncgroupid($masterID);
                sync($client, $other);
                last;
            }
        }
    }
}

```

Slim::Player::Sync::saveSyncPrefs(), Slim/Player/Sync.pm (v5.3.1), 196–214

395. Consider the following set of three SoftSqueeze players, where player1, player2, and player3 are all synchronized together and player 1 is the master.

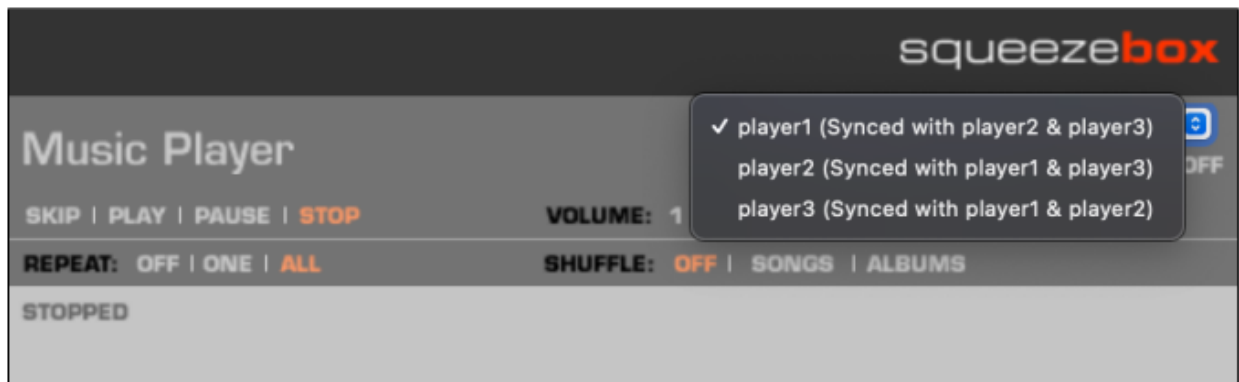
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Name	MAC (client ID)	IP	syncgroupid
player1	bc:39:f3:c4:1e:29	192.168.136.129	482986368
player2	0f:59:51:64:dc:d7	192.168.136.130	482986368
player3	51:93:a5:ad:53:20	192.168.136.131	482986368

396. The preferences file (slimserver.conf) shows all players in the same sync group (482986368), as shown by the following 'grep' search of the preferences file.

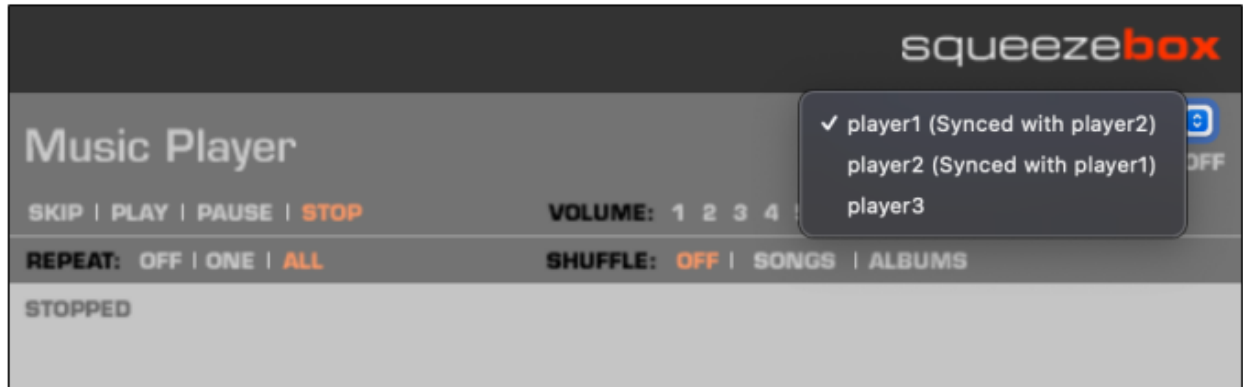
```
[vmuser@slimserver conf]$ grep -P 'playername|syncgroupid' slimserver.conf
0f:59:51:64:dc:d7-playername = player2
0f:59:51:64:dc:d7-syncgroupid = 482986368
51:93:a5:ad:53:20-playername = player3
51:93:a5:ad:53:20-syncgroupid = 482986368
bc:39:f3:c4:1e:29-playername = player1
bc:39:f3:c4:1e:29-syncgroupid = 482986368
```

397. When all three players are powered on, the Web UI shows player1 synchronized with player2 and player3.



398. After pressing the "OFF" button in the Web UI's Music Player pane to power off player3, the Web UI shows player1 and player2 still synced, but player3 is unsynced.

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399. After pressing the "OFF" button in the Web UI's Music Player pane to power off player2, the Web UI shows all players as unsynced.

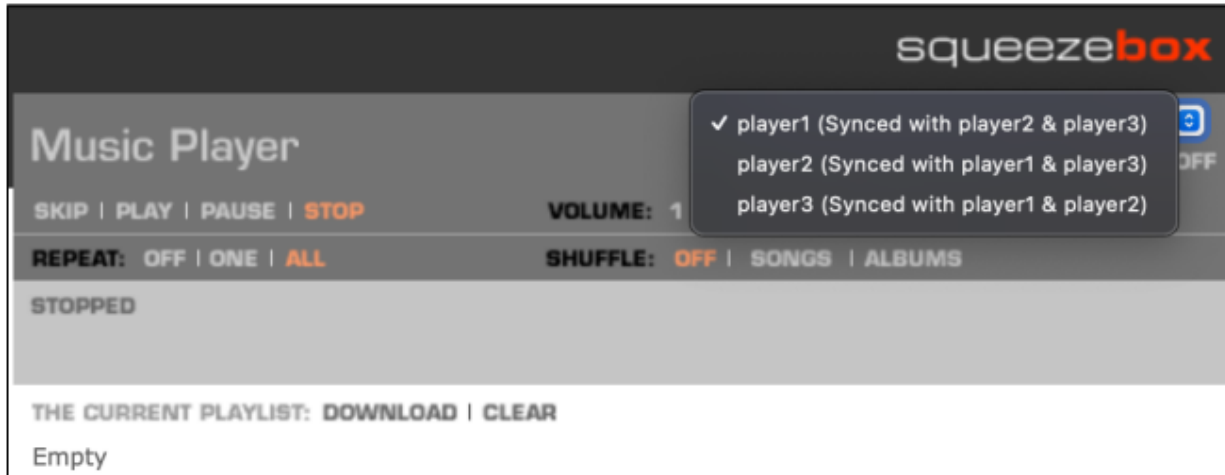


400. Although all players are treated as unsynced when only player1 is on, the preferences file still shows all three players in the same sync group.

```
[vmuser@slimserver conf]$ grep -P 'playername|syncgroupid' slimserver.conf
0f:59:51:64:dc:d7-playername = player2
0f:59:51:64:dc:d7-syncgroupid = 482986368
51:93:a5:ad:53:20-playername = player3
51:93:a5:ad:53:20-syncgroupid = 482986368
bc:39:f3:c4:1e:29-playername = player1
bc:39:f3:c4:1e:29-syncgroupid = 482986368
```

401. After powering on player2 and player3, the Web UI shows all three players synchronized again.

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402. SlimServer v6.2.1 supports a 'serv' SlimProto message from SlimServer to player that tells a player to switch servers.

403. In SlimServer v6.2.1, the 'serv' SlimProto message is only used to tell the player to switch to SqueezeNetwork. The 'serv' message is sent with a host value of 1, representing SqueezeNetwork.

#### Slim/Buttons/SqueezeNetwork.pm (v6.2.1)

```
sub connectSqueezeNetwork {
    my $client = shift;

    # don't disconnect unless we're still in this mode.
    return unless ($client->param('squeezenetwrok.connect'));

    if (clientIsCapable($client)) {
        my $host = pack('N',1); # 1 is squeezenetwrok
        $client->sendFrame('serv', \$host);

        # TODO: ensure client actually received the message

        # if message recieved, client has disconnected
        $client->forgetClient();
    }
}
```

Slim::Buttons::SqueezeNetwork::connectSqueezeNetwork(), Slim/Buttons/SqueezeNetwork.pm (v6.2.1), 90–105 at 97–98

404. The SlimProto TCP Protocol documentation on the current Squeezebox Wiki describes a later version of the 'serv' message.

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**Command: "serv"**

Tells the client to switch to another server.

```

$ip_address    4 bytes in network order; 0x1 means switch to squeezeNetwork
$syncgroupid    (optional) 10 ASCII digits;
                this should be reflected in the HELO command
                (SyncgroupID capability) when the player connects
                to the new server so that it may re-join its sync-group.

```

405. The function of the 'serv' command is described as: "Tells the client to switch to another server." The later version of 'serv' still supports the value of 1 to represent SqueezeNetwork but can also take a four-byte IP address to specify the server. In addition, the later command supports a '\$syncgroupid' optional parameter to enable a player to re-join its sync group when the player connects to the new server. As discussed below, switching servers was possible prior to the serv command or the explanation above.

406. I now discuss an example use of the Squeezebox system that helps to illustrate the functionality of that system with respect to at least claim elements 1.6-1.10. I note that this example uses VMs and Softsqueeze, but that my testing of the hardware Squeezebox confirms that the same setup is available through Squeezeboxes, including my setup of SlimServers and Squeezeboxes over Wi-Fi.

407. In this example, all VMs are configured with a private network, which has network address 192.168.136.0/24.

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Name	Network MAC	Player MAC	IP
slimserver1	00:0C:29:A3:52:C6		192.168.136.128
slimserver2	00:0C:29:3B:B5:D2		192.168.136.135
player1	00:0C:29:45:6F:C2	db:3a:52:e6:70:6b	192.168.136.129
player2	00:0C:29:83:57:01	19:1e:67:04:72:30	192.168.136.130
player3	00:0C:29:B2:5E:60	bc:2a:ae:6b:ab:ce	192.168.136.131

408. I note that the Player MAC is determined by SoftSqueeze and is different from the network MAC of the computer running Softsqueeze.

409. We begin with a fresh installation of SlimServer v5.3.1 on all SlimServer VMs (slimserver1 and slimserver2), accomplished by uninstalling and then re-installing the SlimServer RPM.

```
rpm -e slimserver
rpm -ivh slimserver-5.3.1-1.noarch.rpm
```

410. Then set up Music Folder on slimserver1 and slimserver2 to /mnt/hgfs/Music.

411. On slimserver1 and slimserver2, let the default server installations run automatically. The default configuration stores the preferences file in /etc/slimserver.conf and the log file in /tmp/slimserver.log.

412. On player VMs, remove all Java user preferences.

```
rm -rf ~/.java/.userPrefs
```

413. We follow the directions given by the SlimServer Web UI to launch SoftSqueeze from the web browser. This is equivalent to the direct invocation. We use the browser launch here to more directly follow the instructions given by SlimServer. I note that even though the player is being launched using one SlimServer (e.g., slimserver1), the player can stay running and

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connect to other SlimServers (e.g., slimserver2). Alternatively, we can directly run the JAR file using "java -jar Softsqueeze.jar" (independently of any running SlimServer instance) as previously done.

### Softsqueeze using Java Web Start

You'll be able to run SoftSqueeze on your local machine by following one or two simple steps, depending on whether Java is already installed on your machine.

- ☒ It appears that Java is already installed (good!), so you can go on to step 2.  
*(In case of problems, you can click [here](#) to re-install the Java environment that is required by SoftSqueeze.)*
- ☐ Click to install and run Softsqueeze.  
 You will notice some delay the first time you run Softsqueeze due to the need to download the entire Softsqueeze application. Future uses of the software will only download parts of the application that have been changed, if any, and should start much quicker.  
 You *may* also be prompted to update your version of Java before Softsqueeze itself is started.

### Softsqueeze as an applet

If you have Java installed in you web browser you can also run Softsqueeze as an applet by clicking [here](#).

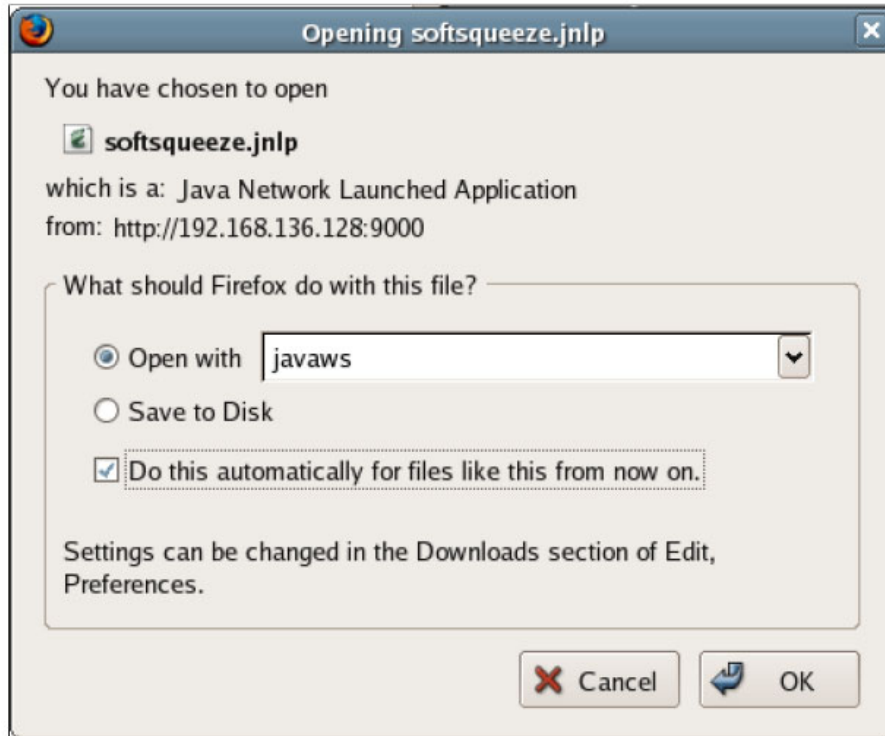
http://<SLIMSERVER\_ADDR>:9000/html/softsqueeze/index.html?player=0f%3A59%3A51%3A64%3Adc%3Ad7

Home / Softsqueeze

HTML/EN/html/softsqueeze/index.html

414. When prompted, use javaws (\$JAVA\_HOME/bin/javaws) to open the softsqueeze.jnlp file:

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415. When prompted, select always trusting the application:



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416. The SoftSqueeze player launches and connects to the server automatically (e.g., by discovery).

417. Using the Web UI, configure the player names. For example,

**Player Name**  
 You can give this player a name that will be used to identify the player on these web pages.  
 Player name:

[http://<SLIMSERVER\\_AP>:9000/setup.html?page=player&player=bc%3A2a%3Aae%3A6b%3Aab%3Ace&playerid=db%3A3a%3A52%3Ae6%3A70%3A6b](http://<SLIMSERVER_AP>:9000/setup.html?page=player&player=bc%3A2a%3Aae%3A6b%3Aab%3Ace&playerid=db%3A3a%3A52%3Ae6%3A70%3A6b)  
 Home / Player Settings

418. After all player names have been configured, the Web UI shows the player names:

**SETTINGS**  

- Server Settings
- Player Settings for player1
- Player Settings for player2
- Player Settings for player3

[http://<SLIMSERVER\\_ADDR>:9000/index.html?player=db:3a:52:e6:70:6b](http://<SLIMSERVER_ADDR>:9000/index.html?player=db:3a:52:e6:70:6b)  
 Home

419. Using the Web UI, press the "OFF" button to power off all players. For example, after turning off player1:

The screenshot shows the 'squeezebox' Music Player interface. At the top right is the 'squeezebox' logo. Below it, the title 'Music Player' is on the left, and 'player1' with a status icon is on the right. The status icon shows 'ON | OFF'. Below the title are controls: 'SKIP | PLAY | PAUSE | STOP' (with 'STOP' in red) and 'VOLUME: 1 2 3 4 5 6 7 8 9 10 11' (with '6' highlighted). Below that are 'REPEAT: OFF | ONE | ALL' (with 'ALL' in red) and 'SHUFFLE: OFF | SONGS | ALBUMS' (with 'OFF' in red). A large grey bar says 'STOPPED'. At the bottom, it says 'THE CURRENT PLAYLIST: DOWNLOAD | CLEAR' and 'Empty'.

[http://<SLIMSERVER\\_ADDR>:9000/index.html?player=db:3a:52:e6:70:6b](http://<SLIMSERVER_ADDR>:9000/index.html?player=db:3a:52:e6:70:6b)  
 Home

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420. At this point, all players are persisted to slimserver1's preferences file with the defined names (player1, player2, and player3), power synchronization "off" (0), no sync groups, and power state "off" (0).

```
[vmuser@slimserver1 ~]$ grep -P 'playername|syncgroup|syncPower|power\b'
/etc/slimserver.conf
19:1e:67:04:72:30-playername = player2
19:1e:67:04:72:30-power = 0
19:1e:67:04:72:30-syncPower = 0
bc:2a:ae:6b:ab:ce-playername = player3
bc:2a:ae:6b:ab:ce-power = 0
bc:2a:ae:6b:ab:ce-syncPower = 0
db:3a:52:e6:70:6b-playername = player1
db:3a:52:e6:70:6b-power = 0
db:3a:52:e6:70:6b-syncPower = 0
```

421. I then define the first sync group on slimserver1. First I set up the logging and network trace for testing purposes. Stop slimserver1, clear the slimserver1 log file, and then start slimserver1. A new log file will be started in /tmp/slimserver.log

```
/etc/rc.d/init.d/slimserver stop
rm /tmp/slimserver.log
/etc/rc.d/init.d/slimserver start
```

422. When slimserver1 restarts, all connected players are powered on. Power all players off using the Web UI. In Home / Server Settings / Debugging, turn on debugging settings related to SlimProto. As a result, information about SlimProto protocol operation is logged to the log file (/tmp/slimserver.log).

<input type="checkbox"/> d_server	Change
<input checked="" type="checkbox"/> d_slimproto	Change
<input checked="" type="checkbox"/> d_slimproto_v	Change
<input type="checkbox"/> d_source	Change

423. Start a network trace.

```
tcpdump -i eth0 -s 0 -w slimserver1-01.pcap
```

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424. We then define the first sync group. Press the right-arrow icon at the bottom-left of the SoftSqueeze player1 to show the remote control.



425. Press the power button to power player1 back up and allow for interaction. The player briefly shows the welcome screen and then transitions to the home screen.



426. Press up arrow to switch to the "Settings" menu item.

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427. Press right arrow to select "Settings" and show the first Settings menu item ("Alarm Clock," setting 1 of 13).



428. Press up arrow to switch to the "Synchronize" menu item (setting 13 of 13).

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429. Press right arrow to select "Synchronize" and show a first synchronization choice (player3).



430. Press up arrow to show another synchronization choice (player2).

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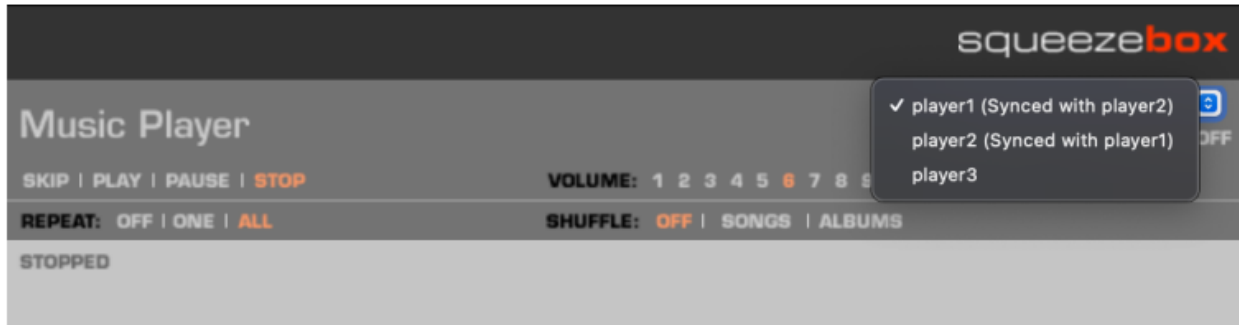


431. Press right arrow to select synchronization with player2. The screen changes to show that player2 is synced, with the menu choice now representing a choice to unsync. The screen change is animated, with the new screen pushing the old screen to the left.



432. The Web UI shows player1 and player2 synced.

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433. slimserver1's preferences file shows player1 and player2 defined in the same sync group (675042355). player1 is powered on. player2 and player3 are powered off.

```
[vmuser@slimserver1 ~]$ grep -P 'playername|syncgroup|syncPower|power\b'
/etc/slimserver.conf
19:1e:67:04:72:30-playername = player2
19:1e:67:04:72:30-power = 0
19:1e:67:04:72:30-syncPower = 0
19:1e:67:04:72:30-syncgroupid = 675042355
bc:2a:ae:6b:ab:ce-playername = player3
bc:2a:ae:6b:ab:ce-power = 0
bc:2a:ae:6b:ab:ce-syncPower = 0
db:3a:52:e6:70:6b-playername = player1
db:3a:52:e6:70:6b-power = 1
db:3a:52:e6:70:6b-syncPower = 0
db:3a:52:e6:70:6b-syncgroupid = 675042355
```

434. As shown above, synchronizing player1 with player3 involves a series of remote control inputs and player1 screens. Both the remote control inputs and resulting screens involve SlimProto network messages between slimserver1 and player1.

- player1 sends "IR " SlimProto messages to slimserver1 for each IR events, such as button presses.
- slimserver1 sends "grfd" SlimProto messages to to player1 to display graphical screens

435. We first identify the IR SlimProto messages, which send IR codes from the player to the SlimServer. From the identified IR messages, the last "right arrow" IR packet represents the "right arrow" button press that initiates sync for player1 and player2. An IR packet is a client-to-server message, which consists of:

- Operation ("IR ") — offset 0, four bytes
- Data Packet Length — offset 4, four bytes

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- Time — offset 8, four bytes
- Format — offset 12, one byte
- NoBits — offset 13, one byte
- IRCode — offset 14, four bytes

#### Client -> Server Communications

A command to the server consists of three parts:

1. The 1st 4 bytes specify the operation. The following operations are supported:
  - HELO
  - IR (note the two spaces after IR)
  - RESP
  - STAT
  - BYE!
2. The 2nd part (of four bytes) is simply the length of the data packet (in Network order).
3. The 3rd part is the data itself.

**"IR "** (Note the two spaces to make it up to 4 characters.)

One of these packets is recieved for each IR code recieved by the player.

**Data Length:** Fixed at 10 bytes.

**Format:**

Time	4 bytes	Time since player startup in ticks (@1Khz)
Format	1 byte	Code Format (ignored by the server for now - Code represents type of IR code - NEC, JVC or Sony)
NoBits	1 byte	Length of IR Code (ignored by the server for now - 16 bits for JVC, 32 bits for NEC?)
IRCode	4 bytes	the IR Code itself (upto 32 bits)

[http://<SLIMSERVER\\_ADDR>:9000/html/docs/slimproto.html](http://<SLIMSERVER_ADDR>:9000/html/docs/slimproto.html)  
HTML/EN/html/docs/slimproto.html

436. The "arrow\_right" IR code is 7689d02f.

- arrow\_right, IR/Slim\_Devices\_Remote.ir (v5.3.1), 21

437. The "right arrow" IR SlimProto packets are then identified using a WireShark display filter that selects for:

- destination port 3483 — from player to SlimServer
- data that begins with "IR " — the IR type

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- data that has 0x7689d02f in the four bytes beginning at offset 14

438. which is expressed as:

```
tcp.dstport == 3483 && data.data[0:4] == "IR " && data.data[14:4] == 76:89:d0:2f
```

439. There are six matching network packets, clustered in groups of two (954/966, 1427/1437, and 1894/1904). Within a cluster, the packets occur very close in time (e.g., within 0.1 seconds for 954/966). Because the clustered IR packets are very close in time, an IR cluster is consistent with a button repeat sequence as handled by the SlimServer IR code.

## Slim/Hardware/IR.pm (v5.3.1)

```
if (($irCodeBytes eq ($client->lastircodebytes())) #same button press as last one
    && ( ($client->irtimediff < $Slim::Hardware::IR::IRMINTIME) #within the minimum time to be
considered a repeat
        || (($client->irtimediff < $client->irrepeattime * 2.02) #or within 2% of twice the
repeat time
            && ($client->irtimediff > $client->irrepeattime * 1.98))) #indicating that a
repeat code was missed
    ) {
        holdCode($client,$irCodeBytes);
        repeatCode($client,$irCodeBytes);
        if (!$client->irrepeattime || ($client->irtimediff > 0 && $client->irtimediff < $client-
>irrepeattime)) {
            #repeat time not yet set or last time diff less than current estimate
            #of repeat time (excluding time diffs less than 0, from out of order packets)
            $client->irrepeattime($client->irtimediff)
        }
    }
```

Slim::Hardware::IR::processIR(), Slim/Hardware/IR.pm (v5.3.1), 334–393 at 365–376

440. The three clusters represent the three "right arrow" presses performed in the synchronization flow described above. The first "right arrow" selects the "Settings" menu item, the second "right arrow" selects the "Synchronize" menu item, and the third "right arrow" selects the sync group to join. The last IR packet cluster (1894 at 20:48:16.074074; 1904 at 20:48:16.164760) thereby represents the "arrow\_right" IR code that initiates the sync.

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tcp.dstport == 3483 && data.data[0:4] == "IR " && data.data[14:4] == 76:89:d0:2f							
No.	Time	Source	Destination	Protocol	Source Port	Destination Port	Length
954	20:47:26.486498	192.168.136.129	192.168.136.128	TCP	32866	3483	84
966	20:47:26.583292	192.168.136.129	192.168.136.128	TCP	32866	3483	84
1427	20:47:51.009815	192.168.136.129	192.168.136.128	TCP	32866	3483	84
1437	20:47:51.101712	192.168.136.129	192.168.136.128	TCP	32866	3483	84
1894	20:48:16.074074	192.168.136.129	192.168.136.128	TCP	32866	3483	84
1904	20:48:16.164760	192.168.136.129	192.168.136.128	TCP	32866	3483	84

441. The slimserver1 log file is consistent with the network trace (modulo a slight time skew between the network stack timestamp and the application logging timestamp).

```
[vmuser@slimserver1 example]$ grep 'op IR ' slimserver-01.log
2022-06-21 20:46:58.1073 Got Slimproto frame, op IR , length 10, IO::Socket::INET=GLOB(0x9ddba54)
2022-06-21 20:46:58.2000 Got Slimproto frame, op IR , length 10, IO::Socket::INET=GLOB(0x9ddba54)
2022-06-21 20:47:11.1490 Got Slimproto frame, op IR , length 10, IO::Socket::INET=GLOB(0x9ddba54)
2022-06-21 20:47:11.2416 Got Slimproto frame, op IR , length 10, IO::Socket::INET=GLOB(0x9ddba54)
2022-06-21 20:47:26.4876 Got Slimproto frame, op IR , length 10, IO::Socket::INET=GLOB(0x9ddba54)
2022-06-21 20:47:26.5846 Got Slimproto frame, op IR , length 10, IO::Socket::INET=GLOB(0x9ddba54)
2022-06-21 20:47:38.8061 Got Slimproto frame, op IR , length 10, IO::Socket::INET=GLOB(0x9ddba54)
2022-06-21 20:47:38.9095 Got Slimproto frame, op IR , length 10, IO::Socket::INET=GLOB(0x9ddba54)
2022-06-21 20:47:51.0111 Got Slimproto frame, op IR , length 10, IO::Socket::INET=GLOB(0x9ddba54)
2022-06-21 20:47:51.1028 Got Slimproto frame, op IR , length 10, IO::Socket::INET=GLOB(0x9ddba54)
2022-06-21 20:48:02.0107 Got Slimproto frame, op IR , length 10, IO::Socket::INET=GLOB(0x9ddba54)
2022-06-21 20:48:02.1029 Got Slimproto frame, op IR , length 10, IO::Socket::INET=GLOB(0x9ddba54)
2022-06-21 20:48:16.0756 Got Slimproto frame, op IR , length 10, IO::Socket::INET=GLOB(0x9ddba54)
2022-06-21 20:48:16.1657 Got Slimproto frame, op IR , length 10, IO::Socket::INET=GLOB(0x9ddba54)
```

442. After packet 1894 (20:48:16.074074), SlimServer responds with a series of eight 'grfd' command packets to the player animating the new screen pushing the old screen off to the left.

```
Slim/Player/SqueezeboxG (v5.3.1)

# push the old screen off the left side
sub pushLeft {
    my $client = shift;
    my $start = shift;
    my $end = shift;

    my $startbits = $client->render($start);
    my $endbits = $client->render($end);

    my $allbits = $$startbits . $$endbits;

    $client->killAnimation();
    $client->pushUpdate([\ $allbits, 0, $screensize / 8, $screensize, 0.025]);
}
```

Slim::Player::SqueezeboxG::pushLeft(), Slim/Player/SqueezeboxG.pm (v5.3.1), 401–414 at 413  
 Slim::Player::SqueezeboxG::pushUpdate(), Slim/Player/SqueezeboxG.pm (v5.3.1), 447–464 at 459

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Slim::Player::SqueezeboxG::drawFrameBuf(), Slim/Player/SqueezeboxG.pm (v5.3.1), 368–382 at 380

443. Each such packet begins with a two-byte length field and a four-byte command field. The 'grfd' are identified in the network trace using a WireShark display filter that selects for:

source port 3483 — from SlimServer to player  
 TCP length > 0 — to filter out pure acknowledgement packets  
 command code 'grfd'  
 destination 192.168.136.129 (player1)

```
tcp.srcport == 3483 && tcp.len > 0 && data.data[2:4] == "grfd" && ip.dst == 192.168.136.129
```

tcp.srcport == 3483 && tcp.len > 0 && data.data[2:4] == "grfd" && ip.dst == 192.168.136.129							
No.	Time	Source	Destination	Protocol	Source Port	Destination Port	Length
1859	20:48:13.294596	192.168.136.128	192.168.136.129	TCP	3483	32866	634
1871	20:48:14.295306	192.168.136.128	192.168.136.129	TCP	3483	32866	634
1883	20:48:15.295355	192.168.136.128	192.168.136.129	TCP	3483	32866	634
1896	20:48:16.079013	192.168.136.128	192.168.136.129	TCP	3483	32866	634
1898	20:48:16.104491	192.168.136.128	192.168.136.129	TCP	3483	32866	634
1900	20:48:16.130371	192.168.136.128	192.168.136.129	TCP	3483	32866	634
1902	20:48:16.156507	192.168.136.128	192.168.136.129	TCP	3483	32866	634
1905	20:48:16.182463	192.168.136.128	192.168.136.129	TCP	3483	32866	634
1907	20:48:16.223287	192.168.136.128	192.168.136.129	TCP	3483	32866	634
1909	20:48:16.234632	192.168.136.128	192.168.136.129	TCP	3483	32866	634
1911	20:48:16.260280	192.168.136.128	192.168.136.129	TCP	3483	32866	634
1915	20:48:16.296642	192.168.136.128	192.168.136.129	TCP	3483	32866	634
1927	20:48:17.296303	192.168.136.128	192.168.136.129	TCP	3483	32866	634
1939	20:48:18.297331	192.168.136.128	192.168.136.129	TCP	3483	32866	634
1951	20:48:19.297665	192.168.136.128	192.168.136.129	TCP	3483	32866	634
1963	20:48:20.298046	192.168.136.128	192.168.136.129	TCP	3483	32866	634
1975	20:48:21.299187	192.168.136.128	192.168.136.129	TCP	3483	32866	634
1987	20:48:22.299218	192.168.136.128	192.168.136.129	TCP	3483	32866	634
1999	20:48:23.299843	192.168.136.128	192.168.136.129	TCP	3483	32866	634

444. The server sends a series of eight 'grfd' packets to player1 (192.168.136.129) starting at packet 1896 (20:48:16.079013) through packet 1911 (20:48:16.260280) with distinct contents, consistent with the "push left" animation. Packets 1444 (20:47:51.195152) through 1883 (20:48:15.295355) have identical 'grfd' payload, consistent with a repeated pre-sync screen:

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445. For example, packet 1871 (20:48:14.295306):

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```

> Frame 1871: 634 bytes on wire (5072 bits), 634 bytes captured (5072 bits)
> Ethernet II, Src: VMware_a3:52:c6 (00:0c:29:a3:52:c6), Dst: VMware_45:6f:c2 (00:0c:29:45:6f:c2)
> Internet Protocol Version 4, Src: 192.168.136.128, Dst: 192.168.136.129
> Transmission Control Protocol, Src Port: 3483, Dst Port: 32866, Seq: 71075, Ack: 4055, Len: 568
> Data (568 bytes)
0000 00 0c 29 45 6f c2 00 0c 29 a3 52 c6 08 00 45 00 ..)Eo... )·R...E·
0010 02 6c 75 56 40 00 40 06 30 e3 c0 a8 88 80 c0 a8 ·luV@·@· 0·.....
0020 88 81 0d 9b 80 62 95 df 58 c5 76 f7 7e 1d 80 18 .....b·· X·v·~·
0030 05 a8 94 b1 00 00 01 01 08 0a 01 ee 3c 23 01 66 .....<#·f
0040 88 d5 02 36 67 72 66 64 02 30 f8 7f a0 7f a0 24 ..·6grfd·0·...·$
0050 a0 44 40 7c 00 38 00 00 f8 00 a1 fe a1 fe a0 00 ·D@|·8· ·.....
0060 58 00 00 0c 00 5e f8 52 a8 52 a8 7e 88 3e 00 00 X·...·^·R·R·~·>·
0070 00 00 48 60 a8 78 a8 3f a8 0c 90 30 00 40 00 00 ··H`·x·? ···0·@·
0080 48 00 a8 3c a8 7e a8 52 90 52 00 72 00 32 00 00 H·<·~·R·R·r·2·
0090 00 00 00 7e 00 7e 00 20 f8 60 a0 60 a0 00 a0 00 ·~·~· ··`·.....
00a0 58 86 01 8e 01 1a f9 f2 00 e2 00 00 70 00 88 00 X·..... ···p·
00b0 88 00 a8 00 b8 00 00 00 00 00 f8 00 20 00 20 00 ..... ····
00c0 20 00 f8 00 00 00 00 00 80 00 80 00 f8 00 80 00 ..... ····
00d0 80 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ..... ····
00e0 80 00 80 00 f8 00 80 00 80 00 00 00 00 00 70 00 ..... ····p·
00f0 88 00 88 00 88 00 70 00 00 00 00 00 00 00 00 .....p· ····
0100 00 00 00 00 00 00 48 00 a8 00 a8 00 a8 00 90 00 .....H· ····
0110 00 00 00 00 80 00 40 00 38 00 40 00 80 00 00 00 .....@· 8·@·
0120 00 00 f8 00 40 00 20 00 10 00 f8 00 00 00 00 00 .....@· ····
0130 70 00 88 00 88 00 88 00 50 00 00 00 00 00 00 00 p·..... P·.....
0140 00 00 00 00 00 00 00 00 f0 00 08 00 08 00 f0 00 ..... ····
0150 08 00 08 00 f0 00 00 00 00 00 f8 00 00 00 00 00 ..... ····
0160 80 00 80 00 f8 00 80 00 80 00 00 00 00 00 f8 00 ..... ····
0170 20 00 20 00 20 00 f8 00 00 00 00 00 48 00 00 00 · · · · · · · · · ·H·
0180 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ..... ····
0190 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ..... ····
01a0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ..... ····
01b0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ..... ····
01c0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ..... ····
01d0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ..... ····
01e0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ..... ····
01f0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ..... ····
0200 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ..... ····
0210 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ..... ····
0220 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ..... ····
0230 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ..... ····
0240 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ..... ····
0250 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ..... ····
0260 00 00 00 00 00 00 00 70 00 70 00 70 00 70 01 fc .....p·p·p·p·
0270 00 f8 00 70 00 20 00 00 00 00 .....p· ··

```

446. Has the same 'grfd' payload as packet 1883 (20:48:15.295355):

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```

> Frame 1883: 634 bytes on wire (5072 bits), 634 bytes captured (5072 bits)
> Ethernet II, Src: VMware_a3:52:c6 (00:0c:29:a3:52:c6), Dst: VMware_45:6f:c2 (00:0c:29:45:6f:c2)
> Internet Protocol Version 4, Src: 192.168.136.128, Dst: 192.168.136.129
> Transmission Control Protocol, Src Port: 3483, Dst Port: 32866, Seq: 71643, Ack: 4093, Len: 568
> Data (568 bytes)
0000  00 0c 29 45 6f c2 00 0c 29 a3 52 c6 08 00 45 00  ..)Eo... )R...E.
0010  02 6c 75 5a 40 00 40 06 30 df c0 a8 88 80 c0 a8  .luZ@.@. 0.....
0020  88 81 0d 9b 80 62 95 df 5a fd 76 f7 7e 43 80 18  ....b.. Z.v~C..
0030  05 a8 94 b1 00 00 01 01 08 0a 01 ee 40 0b 01 66  .......@..f
0040  8c bf 02 36 67 72 66 64 02 30 f8 7f a0 7f a0 24  ..6grfd .0.....$
0050  a0 44 40 7c 00 38 00 00 f8 00 a1 fe a1 fe a0 00  .De|.8.. ....
0060  58 00 00 0c 00 5e f8 52 a8 52 a8 7e 88 3e 00 00  X....^..R .R.~>..
0070  00 00 48 60 a8 78 a8 3f a8 0c 90 30 00 40 00 00  ..H`.x.? ...0.@.
0080  48 00 a8 3c a8 7e a8 52 90 52 00 72 00 32 00 00  H.<~..R .R.r.2..
0090  00 00 00 7e 00 7e 00 20 f8 60 a0 60 a0 00 a0 00  ....~.. ..`.....
00a0  58 86 01 8e 01 1a f9 f2 00 e2 00 00 70 00 88 00  X..... ..p...
00b0  88 00 a8 00 b8 00 00 00 00 00 f8 00 20 00 20 00  .... ..
00c0  20 00 f8 00 00 00 00 00 80 00 80 00 f8 00 80 00  .... ..
00d0  80 00 00 00 00 00 00 00 00 00 00 00 00 00 00  .... ..
00e0  80 00 80 00 f8 00 80 00 80 00 00 00 00 00 70 00  .... ..p.
00f0  88 00 88 00 88 00 70 00 00 00 00 00 00 00 00 00  ....p.
0100  00 00 00 00 00 00 48 00 a8 00 a8 00 90 00 00 00  ....H.
0110  00 00 00 00 80 00 40 00 38 00 40 00 80 00 00 00  ....@. 8.@.
0120  00 00 f8 00 40 00 20 00 10 00 f8 00 00 00 00 00  ....@.
0130  70 00 88 00 88 00 88 00 50 00 00 00 00 00 00 00  p..... P.....
0140  00 00 00 00 00 00 00 00 f0 00 08 00 08 00 f0 00  .... ..
0150  08 00 08 00 f0 00 00 00 00 00 f8 00 00 00 00 00  .... ..
0160  80 00 80 00 f8 00 80 00 80 00 00 00 00 00 f8 00  .... ..
0170  20 00 20 00 20 00 f8 00 00 00 00 48 00 00 00 00  .. . ...H...
0180  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  .... ..
0190  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  .... ..
01a0  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  .... ..
01b0  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  .... ..
01c0  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  .... ..
01d0  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  .... ..
01e0  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  .... ..
01f0  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  .... ..
0200  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  .... ..
0210  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  .... ..
0220  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  .... ..
0230  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  .... ..
0240  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  .... ..
0250  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  .... ..
0260  00 00 00 00 00 00 00 70 00 70 00 70 00 70 01 fc  ....p .p.p.p..
0270  00 f8 00 70 00 20 00 00 00 00  ....p. ..

```

447. The payload for packets 1896 through 1911 differ, shifting off old content and shifting in new content.

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```

> Frame 1896: 634 bytes on wire (5072 bits), 634 bytes captured (5072 bits)
> Ethernet II, Src: VMware_a3:52:c6 (00:0c:29:a3:52:c6), Dst: VMware_45:6f:c2 (00:0c:29:45:6f:c2)
> Internet Protocol Version 4, Src: 192.168.136.128, Dst: 192.168.136.129
> Transmission Control Protocol, Src Port: 3483, Dst Port: 32866, Seq: 72211, Ack: 4149, Len: 568
> Data (568 bytes)
0000 00 0c 29 45 6f c2 00 0c 29 a3 52 c6 08 00 45 00 ..)Eo... )·R...E·
0010 02 6c 75 60 40 00 40 06 30 d9 c0 a8 88 80 c0 a8 ·lu`@·@· 0·.....
0020 88 81 0d 9b 80 62 95 df 5d 35 76 f7 7e 7b 80 18 .....b· ]5v·~{·
0030 05 a8 94 b1 00 00 01 01 08 0a 01 ee 43 1b 01 66 .....C·f
0040 91 42 02 36 67 72 66 64 02 30 00 00 00 7e 00 7e ·B·6grfd ·0·...~·
0050 00 20 f8 60 a0 60 a0 00 a0 00 58 86 01 8e 01 1a ·.·`·.·.·.·X·...·
0060 f9 f2 00 e2 00 00 70 00 88 00 88 00 a8 00 b8 00 .....p· .....
0070 00 00 00 00 f8 00 20 00 20 00 20 00 f8 00 00 00 .....· .....
0080 00 00 80 00 80 00 f8 00 80 00 80 00 00 00 00 00 .....· .....
0090 00 00 00 00 00 00 00 00 00 00 80 00 80 00 f8 00 .....· .....
00a0 80 00 80 00 00 00 00 00 70 00 88 00 88 00 88 00 .....· p· .....
00b0 70 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 p· .....
00c0 48 00 a8 00 a8 00 a8 00 90 00 00 00 00 00 80 00 H· .....
00d0 40 00 38 00 40 00 80 00 00 00 00 00 f8 00 40 00 @·8·@·.· .....@·
00e0 20 00 10 00 f8 00 00 00 00 00 70 00 88 00 88 00 .....· p· .....
00f0 88 00 50 00 00 00 00 00 00 00 00 00 00 00 00 00 ..P· .....
0100 00 00 f0 00 08 00 08 00 f0 00 08 00 08 00 f0 00 .....· .....
0110 00 00 00 00 f8 00 00 00 00 00 80 00 80 00 f8 00 .....· .....
0120 80 00 80 00 00 00 00 00 f8 00 20 00 20 00 20 00 .....· .....
0130 f8 00 00 00 00 00 48 00 00 00 00 00 00 00 00 00 .....· H· .....
0140 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....· .....
0150 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....· .....
0160 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....· .....
0170 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....· .....
0180 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....· .....
0190 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....· .....
01a0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....· .....
01b0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....· .....
01c0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....· .....
01d0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....· .....
01e0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....· .....
01f0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....· .....
0200 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....· .....
0210 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....· .....
0220 00 70 00 70 00 70 00 70 01 fc 00 f8 00 70 00 20 ·p·p·p·p ·····p·
0230 00 00 00 00 f8 7f a0 7f a0 24 a0 44 40 7c 00 38 .....· $·D@|·8
0240 00 00 f8 00 a1 fe a1 fe a0 00 58 00 00 0c 00 5e .....· X· .....^
0250 f8 52 a8 52 a8 7e 88 3e 00 00 00 00 48 60 a8 78 ·R·R·~·> ····H·`x
0260 a8 3f a8 0c 90 30 00 40 00 00 48 00 a8 3c a8 7e ·?·...0·@ ··H·<·~
0270 a8 52 90 52 00 72 00 32 00 00 ·R·R·r·2 ··

```

## Contains Highly Confidential AEO and Source Code Materials

```

> Frame 1898: 634 bytes on wire (5072 bits), 634 bytes captured (5072 bits)
> Ethernet II, Src: VMware_a3:52:c6 (00:0c:29:a3:52:c6), Dst: VMware_45:6f:c2 (00:0c:29:45:6f:c2)
> Internet Protocol Version 4, Src: 192.168.136.128, Dst: 192.168.136.129
> Transmission Control Protocol, Src Port: 3483, Dst Port: 32866, Seq: 72779, Ack: 4149, Len: 568
> Data (568 bytes)
0000 00 0c 29 45 6f c2 00 0c 29 a3 52 c6 08 00 45 00 ..)Eo... )R...E
0010 02 6c 75 62 40 00 40 06 30 d7 c0 a8 88 80 c0 a8 .lub@.@ 0.....
0020 88 81 0d 9b 80 62 95 df 5f 6d 76 f7 7e 7b 80 18 ....b..._mv~{..
0030 05 a8 94 b1 00 00 01 01 08 0a 01 ee 43 35 01 66 .....C5.f
0040 91 47 02 36 67 72 66 64 02 30 00 00 00 00 00 00 .G.6grfd .0.....
0050 00 00 00 00 80 00 80 00 f8 00 80 00 80 00 00 00 .....
0060 00 00 70 00 88 00 88 00 88 00 70 00 00 00 00 00 ..p..... p.....
0070 00 00 00 00 00 00 00 00 00 00 48 00 a8 00 a8 00 ..... H.....
0080 a8 00 90 00 00 00 00 00 80 00 40 00 38 00 40 00 ..... @.8.@.
0090 80 00 00 00 00 00 f8 00 40 00 20 00 10 00 f8 00 ..... @.....
00a0 00 00 00 00 70 00 88 00 88 00 88 00 50 00 00 00 ..... p... P...
00b0 00 00 00 00 00 00 00 00 00 00 00 00 f0 00 08 00 .....
00c0 08 00 f0 00 08 00 08 00 f0 00 00 00 00 00 f8 00 .....
00d0 00 00 00 00 80 00 80 00 f8 00 80 00 80 00 00 00 .....
00e0 00 00 f8 00 20 00 20 00 20 00 f8 00 00 00 00 00 .... .
00f0 48 00 00 00 00 00 00 00 00 00 00 00 00 00 00 H.....
0100 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
0110 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
0120 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
0130 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
0140 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
0150 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
0160 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
0170 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
0180 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
0190 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
01a0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
01b0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
01c0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
01d0 00 00 00 00 00 00 00 00 00 00 00 70 00 70 00 70 ..... p.p.p
01e0 00 70 01 fc 00 f8 00 70 00 20 00 00 00 00 f8 7f .p.....p
01f0 a0 7f a0 24 a0 44 40 7c 00 38 00 00 f8 00 a1 fe ...$.D@| .8.....
0200 a1 fe a0 00 58 00 00 0c 00 5e f8 52 a8 52 a8 7e ....X... ^.R.R~
0210 88 3e 00 00 00 00 48 60 a8 78 a8 3f a8 0c 90 30 .>...H` .x.?..0
0220 00 40 00 00 48 00 a8 3c a8 7e a8 52 90 52 00 72 .@..H.< ~.R.R.r
0230 00 32 00 00 00 00 00 7e 00 7e 00 20 f8 60 a0 60 .2.....~ ..`..
0240 a0 00 a0 00 58 86 01 8e 01 1a f9 f2 00 e2 00 00 ....X...
0250 70 00 88 00 88 00 a8 00 b8 00 00 00 00 00 f8 00 p.....
0260 20 00 20 00 20 00 f8 00 00 00 00 80 00 80 00 . . .
0270 f8 00 80 00 80 00 00 00 00 00 .....

```

Contains Highly Confidential AEO and Source Code Materials

```

> Frame 1900: 634 bytes on wire (5072 bits), 634 bytes captured (5072 bits)
> Ethernet II, Src: VMware_a3:52:c6 (00:0c:29:a3:52:c6), Dst: VMware_45:6f:c2 (00:0c:29:45:6f:c2)
> Internet Protocol Version 4, Src: 192.168.136.128, Dst: 192.168.136.129
> Transmission Control Protocol, Src Port: 3483, Dst Port: 32866, Seq: 73347, Ack: 4149, Len: 568
> Data (568 bytes)
0000 00 0c 29 45 6f c2 00 0c 29 a3 52 c6 08 00 45 00 ..)Eo... )·R...E·
0010 02 6c 75 64 40 00 40 06 30 d5 c0 a8 88 80 c0 a8 ·Lud@·@· 0·.....
0020 88 81 0d 9b 80 62 95 df 61 a5 76 f7 7e 7b 80 18 .....b· a·v~{·
0030 05 a8 94 b1 00 00 01 01 08 0a 01 ee 43 4f 01 66 .....CO·f
0040 91 61 02 36 67 72 66 64 02 30 80 00 00 00 00 00 ·a·6grfd·0·.....
0050 f8 00 40 00 20 00 10 00 f8 00 00 00 00 00 70 00 ·@· ... ·····p·
0060 88 00 88 00 88 00 50 00 00 00 00 00 00 00 00 00 .....P· .....
0070 00 00 00 00 00 00 f0 00 08 00 08 00 f0 00 08 00 .....
0080 08 00 f0 00 00 00 00 00 f8 00 00 00 00 00 80 00 .....
0090 80 00 f8 00 80 00 80 00 00 00 00 00 f8 00 20 00 .....
00a0 20 00 20 00 f8 00 00 00 00 00 48 00 00 00 00 00 · .....·H·.....
00b0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
00c0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
00d0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
00e0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
00f0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
0100 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
0110 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
0120 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
0130 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
0140 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
0150 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
0160 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
0170 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
0180 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
0190 00 00 00 00 00 00 70 00 70 00 70 00 70 01 fc 00 f8 .....p·p·p·p·
01a0 00 70 00 20 00 00 00 00 f8 7f a0 7f a0 24 a0 44 ·p· .....·$·D·
01b0 40 7c 00 38 00 00 f8 00 a1 fe a1 fe a0 00 58 00 @|·8· .....·X·
01c0 00 0c 00 5e f8 52 a8 52 a8 7e 88 3e 00 00 00 00 .....^·R·R·~·>·
01d0 48 60 a8 78 a8 3f a8 0c 90 30 00 40 00 00 48 00 H·x·?· ·0·@·H·
01e0 a8 3c a8 7e a8 52 90 52 00 72 00 32 00 00 00 00 <~·R·R·r·2·
01f0 00 7e 00 7e 00 20 f8 60 a0 60 a0 00 a0 00 58 86 ~·~· ·`· .....X·
0200 01 8e 01 1a f9 f2 00 e2 00 00 70 00 88 00 88 00 .....p·
0210 a8 00 b8 00 00 00 00 00 f8 00 20 00 20 00 20 00 .....
0220 f8 00 00 00 00 00 80 00 80 00 f8 00 80 00 80 00 .....
0230 00 00 00 00 00 00 00 00 00 00 00 00 00 80 00 .....
0240 80 00 f8 00 80 00 80 00 00 00 00 00 70 00 88 00 .....p·
0250 88 00 88 00 70 00 00 00 00 00 00 00 00 00 00 .....p·
0260 00 00 00 00 f0 00 08 00 08 00 08 00 f0 00 00 00 .....
0270 00 00 f8 00 40 00 20 00 10 00 .....@· ..

```

Contains Highly Confidential AEO and Source Code Materials

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> Frame 1902: 634 bytes on wire (5072 bits), 634 bytes captured (5072 bits)
> Ethernet II, Src: VMware_a3:52:c6 (00:0c:29:a3:52:c6), Dst: VMware_45:6f:c2 (00:0c:29:45:6f:c2)
> Internet Protocol Version 4, Src: 192.168.136.128, Dst: 192.168.136.129
> Transmission Control Protocol, Src Port: 3483, Dst Port: 32866, Seq: 73915, Ack: 4149, Len: 568
> Data (568 bytes)
0000 00 0c 29 45 6f c2 00 0c 29 a3 52 c6 08 00 45 00 ..)Eo... )R...E
0010 02 6c 75 66 40 00 40 06 30 d3 c0 a8 88 80 c0 a8 .luf@.@ 0.....
0020 88 81 0d 9b 80 62 95 df 63 dd 76 f7 7e 7b 80 18 ....b..c.v~{..
0030 05 a8 94 b1 00 00 01 01 08 0a 01 ee 43 69 01 66 .....Ci.f
0040 91 7b 02 36 67 72 66 64 02 30 80 00 f8 00 80 00 .{.6grfd .0.....
0050 80 00 00 00 00 00 f8 00 20 00 20 00 20 00 f8 00 .....
0060 00 00 00 00 48 00 00 00 00 00 00 00 00 00 00 ...H...
0070 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
0080 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
0090 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
00a0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
00b0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
00c0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
00d0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
00e0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
00f0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
0100 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
0110 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
0120 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
0130 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
0140 00 00 00 00 00 00 00 00 00 00 00 00 00 00 70 .....p
0150 00 70 00 70 00 70 01 fc 00 f8 00 70 00 20 00 00 .p.p.p...p...
0160 00 00 f8 7f a0 7f a0 24 a0 44 40 7c 00 38 00 00 .....$ .D@|.8..
0170 f8 00 a1 fe a1 fe a0 00 58 00 00 0c 00 5e f8 52 .....X.....^R
0180 a8 52 a8 7e 88 3e 00 00 00 48 60 a8 78 a8 3f .R~>...H`x?
0190 a8 0c 90 30 00 40 00 00 48 00 a8 3c a8 7e a8 52 ...0.@..H<~R
01a0 90 52 00 72 00 32 00 00 00 00 00 7e 00 7e 00 20 .R.r.2...~..
01b0 f8 60 a0 60 a0 00 a0 00 58 86 01 8e 01 1a f9 f2 .`..X.....
01c0 00 e2 00 00 70 00 88 00 88 00 a8 00 b8 00 00 00 ...p.....
01d0 00 00 f8 00 20 00 20 00 20 00 f8 00 00 00 00 00 .....
01e0 80 00 80 00 f8 00 80 00 80 00 00 00 00 00 00 .....
01f0 00 00 00 00 00 00 00 00 80 00 80 00 f8 00 80 00 .....
0200 80 00 00 00 00 00 70 00 88 00 88 00 88 00 70 00 .....p.....p
0210 00 00 00 00 00 00 00 00 00 00 00 00 00 00 f0 00 .....
0220 08 00 08 00 08 00 f0 00 00 00 00 00 f8 00 40 00 .....@
0230 20 00 10 00 f8 00 00 00 00 00 48 00 a8 00 a8 00 .....H.....
0240 a8 00 90 00 00 00 00 00 80 00 40 00 38 00 40 00 .....@.8.@
0250 80 00 00 00 00 00 f8 00 40 00 20 00 10 00 f8 00 .....@.....
0260 00 00 00 00 70 00 88 00 88 00 88 00 50 00 00 00 ...p.....P...
0270 00 00 00 00 00 00 00 00 00 00

```

Contains Highly Confidential AEO and Source Code Materials

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> Frame 1905: 634 bytes on wire (5072 bits), 634 bytes captured (5072 bits)
> Ethernet II, Src: VMware_a3:52:c6 (00:0c:29:a3:52:c6), Dst: VMware_45:6f:c2 (00:0c:29:45:6f:c2)
> Internet Protocol Version 4, Src: 192.168.136.128, Dst: 192.168.136.129
> Transmission Control Protocol, Src Port: 3483, Dst Port: 32866, Seq: 74483, Ack: 4167, Len: 568
> Data (568 bytes)
0000 00 0c 29 45 6f c2 00 0c 29 a3 52 c6 08 00 45 00 ..)Eo... )R...E-
0010 02 6c 75 68 40 00 40 06 30 d1 c0 a8 88 80 c0 a8 .luh@.@ 0.....
0020 88 81 0d 9b 80 62 95 df 66 15 76 f7 7e 8d 80 18 ....b... f.v.~...
0030 05 a8 94 b1 00 00 01 01 08 0a 01 ee 43 83 01 66 .....C..f
0040 91 9d 02 36 67 72 66 64 02 30 00 00 00 00 00 00 ...6grfd .0.....
0050 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
0060 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
0070 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
0080 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
0090 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
00a0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
00b0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
00c0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
00d0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
00e0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
00f0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
0100 00 00 00 00 00 00 00 00 00 70 00 70 00 70 00 70 ..... p.p.p.p
0110 01 fc 00 f8 00 70 00 20 00 00 00 00 f8 7f a0 7f .....p.....
0120 a0 24 a0 44 40 7c 00 38 00 00 f8 00 a1 fe a1 fe $.D@|.8 .....
0130 a0 00 58 00 00 0c 00 5e f8 52 a8 52 a8 7e 88 3e ..X...^ .R.R.~>
0140 00 00 00 00 48 60 a8 78 a8 3f a8 0c 90 30 00 40 ...H`.x .?...0.@
0150 00 00 48 00 a8 3c a8 7e a8 52 90 52 00 72 00 32 ..H.<~ .R.R.r.2
0160 00 00 00 00 00 7e 00 7e 00 20 f8 60 a0 60 a0 00 .....~.. .`..
0170 a0 00 58 86 01 8e 01 1a f9 f2 00 e2 00 00 70 00 ..X.....p.
0180 88 00 88 00 a8 00 b8 00 00 00 00 00 f8 00 20 00 ..a000b000f8002000
0190 20 00 20 00 f8 00 00 00 00 00 80 00 80 00 f8 00 .....
01a0 80 00 80 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
01b0 00 00 80 00 80 00 f8 00 80 00 80 00 00 00 00 00 .....
01c0 70 00 88 00 88 00 88 00 70 00 00 00 00 00 00 00 p.....p.....
01d0 00 00 00 00 00 00 00 00 f0 00 08 00 08 00 08 00 .....
01e0 f0 00 00 00 00 00 f8 00 40 00 20 00 10 00 f8 00 .....@.....
01f0 00 00 00 00 48 00 a8 00 a8 00 a8 00 90 00 00 00 ....H... ..
0200 00 00 80 00 40 00 38 00 40 00 80 00 00 00 00 00 ....@.8. @.....
0210 f8 00 40 00 20 00 10 00 f8 00 00 00 00 00 70 00 ..@. ...p.
0220 88 00 88 00 88 00 50 00 00 00 00 00 00 00 00 00 .....P.....
0230 00 00 00 00 00 00 f0 00 08 00 08 00 f0 00 08 00 .....
0240 08 00 f0 00 00 00 00 00 f8 00 00 00 00 00 80 00 .....
0250 80 00 f8 00 80 00 80 00 00 00 00 00 f8 00 20 00 .....
0260 20 00 20 00 f8 00 00 00 00 00 48 00 00 00 00 00 .....H.....
0270 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....

```

Contains Highly Confidential AEO and Source Code Materials

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> Frame 1907: 634 bytes on wire (5072 bits), 634 bytes captured (5072 bits)
> Ethernet II, Src: VMware_a3:52:c6 (00:0c:29:a3:52:c6), Dst: VMware_45:6f:c2 (00:0c:29:45:6f:c2)
> Internet Protocol Version 4, Src: 192.168.136.128, Dst: 192.168.136.129
> Transmission Control Protocol, Src Port: 3483, Dst Port: 32866, Seq: 75051, Ack: 4167, Len: 568
> Data (568 bytes)

0000  00 0c 29 45 6f c2 00 0c 29 a3 52 c6 08 00 45 00  ..)Eo... )R...E-
0010  02 6c 75 6a 40 00 40 06 30 cf c0 a8 88 80 c0 a8  .luj@.@ 0.....
0020  88 81 0d 9b 80 62 95 df 68 4d 76 f7 7e 8d 80 18  ....b...hMv~...
0030  05 a8 94 b1 00 00 01 01 08 0a 01 ee 43 ac 01 66  ....C..f
0040  91 d7 02 36 67 72 66 64 02 30 00 00 00 00 00 00  ..6grfd 0.....
0050  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  .....
0060  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  .....
0070  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  .....
0080  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  .....
0090  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  .....
00a0  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  .....
00b0  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  .....
00c0  00 00 00 70 00 70 00 70 00 70 01 fc 00 f8 00 70  ..p.p.p.p.....p
00d0  00 20 00 00 00 00 f8 7f a0 7f a0 24 a0 44 40 7c  . ....$.D@|
00e0  00 38 00 00 f8 00 a1 fe a1 fe a0 00 58 00 00 0c  .8.....X...
00f0  00 5e f8 52 a8 52 a8 7e 88 3e 00 00 00 00 48 60  .^R.R~>...H`
0100  a8 78 a8 3f a8 0c 90 30 00 40 00 00 48 00 a8 3c  .x.7...0 @..H.<
0110  a8 7e a8 52 90 52 00 72 00 32 00 00 00 00 7e  ..R.R.r.2....~
0120  00 7e 00 20 f8 60 a0 60 a0 00 a0 00 58 86 01 8e  .~.``.X...
0130  01 1a f9 f2 00 e2 00 00 70 00 88 00 88 00 a8 00  .....p.....
0140  b8 00 00 00 00 00 f8 00 20 00 20 00 20 00 f8 00  .....
0150  00 00 00 00 80 00 80 00 f8 00 80 00 80 00 00 00  .....
0160  00 00 00 00 00 00 00 00 00 00 00 00 80 00 80 00  .....
0170  f8 00 80 00 80 00 00 00 00 00 70 00 88 00 88 00  .....p.....
0180  88 00 70 00 00 00 00 00 00 00 00 00 00 00 00 00  ..p.....
0190  00 00 f0 00 08 00 08 00 08 00 f0 00 00 00 00 00  .....
01a0  f8 00 40 00 20 00 10 00 f8 00 00 00 00 00 48 00  ..@. ....H.
01b0  a8 00 a8 00 a8 00 90 00 00 00 00 00 80 00 40 00  .....@.
01c0  38 00 40 00 80 00 00 00 00 00 f8 00 40 00 20 00  8@.....@.
01d0  10 00 f8 00 00 00 00 00 70 00 88 00 88 00 88 00  .....p.....
01e0  50 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  P.....
01f0  f0 00 08 00 08 00 f0 00 08 00 08 00 f0 00 00 00  .....
0200  00 00 f8 00 00 00 00 00 80 00 80 00 f8 00 80 00  .....
0210  80 00 00 00 00 00 f8 00 20 00 20 00 20 00 f8 00  .....
0220  00 00 00 00 48 00 00 00 00 00 00 00 00 00 00 00  ....H...
0230  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  .....
0240  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  .....
0250  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  .....
0260  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  .....
0270  00 00 00 00 00 00 00 00 00 00  .....

```

## Contains Highly Confidential AEO and Source Code Materials

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> Frame 1909: 634 bytes on wire (5072 bits), 634 bytes captured (5072 bits)
> Ethernet II, Src: VMware_a3:52:c6 (00:0c:29:a3:52:c6), Dst: VMware_45:6f:c2 (00:0c:29:45:6f:c2)
> Internet Protocol Version 4, Src: 192.168.136.128, Dst: 192.168.136.129
> Transmission Control Protocol, Src Port: 3483, Dst Port: 32866, Seq: 75619, Ack: 4167, Len: 568
> Data (568 bytes)
0000 00 0c 29 45 6f c2 00 0c 29 a3 52 c6 08 00 45 00 ..)Eo... )R...E.
0010 02 6c 75 6c 40 00 40 06 30 cd c0 a8 88 80 c0 a8 .lul@.@ 0.....
0020 88 81 0d 9b 80 62 95 df 6a 85 76 f7 7e 8d 80 18 ....b.. j.v~...
0030 05 a8 94 b1 00 00 01 01 08 0a 01 ee 43 b7 01 66 .....C..f
0040 91 d8 02 36 67 72 66 64 02 30 00 00 00 00 00 00 ..6grfd .0.....
0050 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
0060 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
0070 00 00 00 00 00 00 00 00 00 00 00 00 00 70 00 70 .....p.p
0080 00 70 00 70 01 fc 00 f8 00 70 00 20 00 00 00 00 00 .p.p... .p....
0090 f8 7f a0 7f a0 24 a0 44 40 7c 00 38 00 00 f8 00 ....$.D @|.8....
00a0 a1 fe a1 fe a0 00 58 00 00 0c 00 5e f8 52 a8 52 ....X. ....^R.R
00b0 a8 7e 88 3e 00 00 00 00 48 60 a8 78 a8 3f a8 0c ..>... H`.x.?..
00c0 90 30 00 40 00 00 48 00 a8 3c a8 7e a8 52 90 52 .0.@.H. <~R.R
00d0 00 72 00 32 00 00 00 00 00 7e 00 7e 00 20 f8 60 .r.2.... ~~~.
00e0 a0 60 a0 00 a0 00 58 86 01 8e 01 1a f9 f2 00 e2 .X. ....
00f0 00 00 70 00 88 00 88 00 a8 00 b8 00 00 00 00 00 .p....
0100 f8 00 20 00 20 00 20 00 f8 00 00 00 00 00 80 00 . . .
0110 80 00 f8 00 80 00 80 00 00 00 00 00 00 00 00 00 .....
0120 00 00 00 00 00 00 80 00 80 00 f8 00 80 00 80 00 .....
0130 00 00 00 00 70 00 88 00 88 00 88 00 70 00 00 00 ...p... .p...
0140 00 00 00 00 00 00 00 00 00 00 00 00 f0 00 08 00 .....
0150 08 00 08 00 f0 00 00 00 00 00 f8 00 40 00 20 00 .....@.
0160 10 00 f8 00 00 00 00 00 48 00 a8 00 a8 00 a8 00 .....H.....
0170 90 00 00 00 00 00 80 00 40 00 38 00 40 00 80 00 .....@.8.@...
0180 00 00 00 00 f8 00 40 00 20 00 10 00 f8 00 00 00 .....@.
0190 00 00 70 00 88 00 88 00 88 00 50 00 00 00 00 00 .p.... .P....
01a0 00 00 00 00 00 00 00 00 00 00 f0 00 08 00 08 00 .....
01b0 f0 00 08 00 08 00 f0 00 00 00 00 00 f8 00 00 00 .....
01c0 00 00 80 00 80 00 f8 00 80 00 80 00 00 00 00 00 .....
01d0 f8 00 20 00 20 00 20 00 f8 00 00 00 00 00 48 00 . . . .H.
01e0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
01f0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
0200 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
0210 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
0220 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
0230 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
0240 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
0250 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
0260 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
0270 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....

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Contains Highly Confidential AEO and Source Code Materials

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> Frame 1911: 634 bytes on wire (5072 bits), 634 bytes captured (5072 bits)
> Ethernet II, Src: VMware_a3:52:c6 (00:0c:29:a3:52:c6), Dst: VMware_45:6f:c2 (00:0c:29:45:6f:c2)
> Internet Protocol Version 4, Src: 192.168.136.128, Dst: 192.168.136.129
> Transmission Control Protocol, Src Port: 3483, Dst Port: 32866, Seq: 76187, Ack: 4167, Len: 568
> Data (568 bytes)
0000  00 0c 29 45 6f c2 00 0c 29 a3 52 c6 08 00 45 00  ..)Eo... )R...E.
0010  02 6c 75 6e 40 00 40 06 30 cb c0 a8 88 80 c0 a8  .lun@. 0.....
0020  88 81 0d 9b 80 62 95 df 6c bd 76 f7 7e 8d 80 18  ....b...l.v~...
0030  05 a8 94 b1 00 00 01 01 08 0a 01 ee 43 d1 01 66  ....C..f
0040  91 e3 02 36 67 72 66 64 02 30 f8 7f a0 7f a0 24  ..6grfd..0....$
0050  a0 44 40 7c 00 38 00 00 f8 00 a1 fe a1 fe a0 00  .D@|.8... ..
0060  58 00 00 0c 00 5e f8 52 a8 52 a8 7e 88 3e 00 00  X....^..R..R~>..
0070  00 00 48 60 a8 78 a8 3f a8 0c 90 30 00 40 00 00  ..H`.x.? ...0.@..
0080  48 00 a8 3c a8 7e a8 52 90 52 00 72 00 32 00 00  H.<~..R..R.r.2..
0090  00 00 00 7e 00 7e 00 20 f8 60 a0 60 a0 00 a0 00  ..~.. ..
00a0  58 86 01 8e 01 1a f9 f2 00 e2 00 00 70 00 88 00  X..... ..p...
00b0  88 00 a8 00 b8 00 00 00 00 00 f8 00 20 00 20 00  ....
00c0  20 00 f8 00 00 00 00 00 80 00 80 00 f8 00 80 00  ....
00d0  80 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
00e0  80 00 80 00 f8 00 80 00 80 00 00 00 00 00 70 00  ....p.
00f0  88 00 88 00 88 00 70 00 00 00 00 00 00 00 00  ....p.
0100  00 00 00 00 00 00 00 f0 08 00 08 00 08 00 f0 00  ....
0110  00 00 00 00 f8 00 40 00 20 00 10 00 f8 00 00 00  ....@.
0120  00 00 48 00 a8 00 a8 00 a8 00 90 00 00 00 00 00  ..H.....
0130  80 00 40 00 38 00 40 00 80 00 00 00 00 00 f8 00  .@.8.@.
0140  40 00 20 00 10 00 f8 00 00 00 00 00 70 00 88 00  @. ....p...
0150  88 00 88 00 50 00 00 00 00 00 00 00 00 00 00  ....P...
0160  00 00 00 00 f0 00 08 00 08 00 f0 00 08 00 08 00  ....
0170  f0 00 00 00 00 00 f8 00 00 00 00 00 80 00 80 00  ....
0180  f8 00 80 00 80 00 00 00 00 00 f8 00 20 00 20 00  ....
0190  20 00 f8 00 00 00 00 00 48 00 00 00 00 00 00 00  ....H.....
01a0  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
01b0  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
01c0  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
01d0  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
01e0  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
01f0  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
0200  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
0210  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
0220  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
0230  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
0240  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
0250  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
0260  00 00 00 00 00 00 70 00 70 00 70 00 70 01 fc  ....p.p.p.p.
0270  00 f8 00 70 00 20 00 00 00 00  ....p.

```

448. Packets 1915 through 2086 (the last 'grfd' packet in the trace) contain the same 'grfd' payload as packet 1911. For example, packet 1915:

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> Frame 1915: 634 bytes on wire (5072 bits), 634 bytes captured (5072 bits)
> Ethernet II, Src: VMware_a3:52:c6 (00:0c:29:a3:52:c6), Dst: VMware_45:6f:c2 (00:0c:29:45:6f:c2)
> Internet Protocol Version 4, Src: 192.168.136.128, Dst: 192.168.136.129
> Transmission Control Protocol, Src Port: 3483, Dst Port: 32866, Seq: 76755, Ack: 4167, Len: 568
> Data (568 bytes)

0000 00 0c 29 45 6f c2 00 0c 29 a3 52 c6 08 00 45 00 ..)Eo... )R...E.
0010 02 6c 75 70 40 00 40 06 30 c9 c0 a8 88 80 c0 a8 ..lup@.@. 0.....
0020 88 81 0d 9b 80 62 95 df 6e f5 76 f7 7e 8d 80 18 .....b..n.v~...
0030 05 a8 94 b1 00 00 01 01 08 0a 01 ee 43 f5 01 66 .....n...C..f
0040 91 fd 02 36 67 72 66 64 02 30 f8 7f a0 7f a0 24 ...6grfd..0....$
0050 a0 44 40 7c 00 38 00 00 f8 00 a1 fe a1 fe a0 00 ..D@|.8.. ....
0060 58 00 00 0c 00 5e f8 52 a8 52 a8 7e 88 3e 00 00 X...^..R..R~>..
0070 00 00 48 60 a8 78 a8 3f a8 0c 90 30 00 40 00 00 ..H..x.? ...0.@..
0080 48 00 a8 3c a8 7e a8 52 90 52 00 72 00 32 00 00 H..<~..R..R.r.2..
0090 00 00 00 7e 00 7e 00 20 f8 60 a0 60 a0 00 a0 00 ..~..~..`..`....
00a0 58 86 01 8e 01 1a f9 f2 00 e2 00 00 70 00 88 00 X.....p...
00b0 88 00 a8 00 b8 00 00 00 00 00 f8 00 20 00 20 00 .....
00c0 20 00 f8 00 00 00 00 00 80 00 80 00 f8 00 80 00 .....
00d0 80 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
00e0 80 00 80 00 f8 00 80 00 80 00 00 00 00 00 70 00 .....p.
00f0 88 00 88 00 88 00 70 00 00 00 00 00 00 00 00 .....p. ....
0100 00 00 00 00 00 00 f0 00 08 00 08 00 08 00 f0 00 .....
0110 00 00 00 00 f8 00 40 00 20 00 10 00 f8 00 00 00 .....@. ....
0120 00 00 48 00 a8 00 a8 00 a8 00 90 00 00 00 00 00 ..H.....
0130 80 00 40 00 38 00 40 00 80 00 00 00 00 00 f8 00 ..@.8.@. ....
0140 40 00 20 00 10 00 f8 00 00 00 00 00 70 00 88 00 @. ....p...
0150 88 00 88 00 50 00 00 00 00 00 00 00 00 00 00 ....P...
0160 00 00 00 00 f0 00 08 00 08 00 f0 00 08 00 08 00 .....
0170 f0 00 00 00 00 00 f8 00 00 00 00 00 80 00 80 00 .....
0180 f8 00 80 00 80 00 00 00 00 00 f8 00 20 00 20 00 .....
0190 20 00 f8 00 00 00 00 00 48 00 00 00 00 00 00 00 .....H.....
01a0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
01b0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
01c0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
01d0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
01e0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
01f0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
0200 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
0210 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
0220 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
0230 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
0240 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
0250 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
0260 00 00 00 00 00 00 00 70 00 70 00 70 00 01 fc .....p.p.p.p..
0270 00 f8 00 70 00 20 00 00 00 00 .....p.. ..
```

449. The slimserver1 log entries are consistent with the network trace. Filtering the slimserver1 log shows player-to-server IR codes and server-to-player SlimProto frames:

```
grep -P 'op IR |sending squeezebox frame' slimserver-01.log
```

450. The filtered results show a last IR packet cluster at 20:48:16.0756 and 20:48:16.1657, representing the "right arrow" that initiates the sync. There are eight 'grfd' messages following the 20:48:16.0756 IR packet, with the eighth 'grfd' packet at 20:48:16.2601.

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451. The timestamp for that eighth 'grfd' packet (20:48:16.2601) is consistent with the network timestamp for packet 1911 (20:48:16.260280), modulo skew between the application logging and network timestamps.

```

2022-06-21 20:48:15.2952 sending squeezebox frame: grfd, length: 562
2022-06-21 20:48:15.3068 sending squeezebox frame: grfd, length: 562
2022-06-21 20:48:16.0756 Got Slimproto frame, op IR , length 10, IO::Socket::INET=GLOB(0x9ddba54)
2022-06-21 20:48:16.0789 sending squeezebox frame: grfd, length: 562
2022-06-21 20:48:16.1043 sending squeezebox frame: grfd, length: 562
2022-06-21 20:48:16.1302 sending squeezebox frame: grfd, length: 562
2022-06-21 20:48:16.1564 sending squeezebox frame: grfd, length: 562
2022-06-21 20:48:16.1657 Got Slimproto frame, op IR , length 10, IO::Socket::INET=GLOB(0x9ddba54)
2022-06-21 20:48:16.1823 sending squeezebox frame: grfd, length: 562
2022-06-21 20:48:16.2083 sending squeezebox frame: grfd, length: 562
2022-06-21 20:48:16.2344 sending squeezebox frame: grfd, length: 562
2022-06-21 20:48:16.2601 sending squeezebox frame: grfd, length: 562
2022-06-21 20:48:16.2872 sending squeezebox frame: grfd, length: 562
2022-06-21 20:48:16.2965 sending squeezebox frame: grfd, length: 562

```

452. Consequently, packet 1911 (20:48:16.260280) represents the 'grfd' message sent from slimserver1 to player1 with the post-sync screen:



453. We now define the second sync group on slimserver2. To set up the login and network trace, we stop slimserver2, clear the slimserver2 log file, and then start slimserver2. A new log file will be started in /tmp/slimserver.log.

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```
/etc/rc.d/init.d/slimserver stop  
rm /tmp/slimserver.log  
/etc/rc.d/init.d/slimserver start
```

454. In Home / Server Settings / Debugging, turn on debugging settings related to SlimProto. As a result, information about SlimProto protocol operation is logged to the log file (/tmp/slimserver.log).

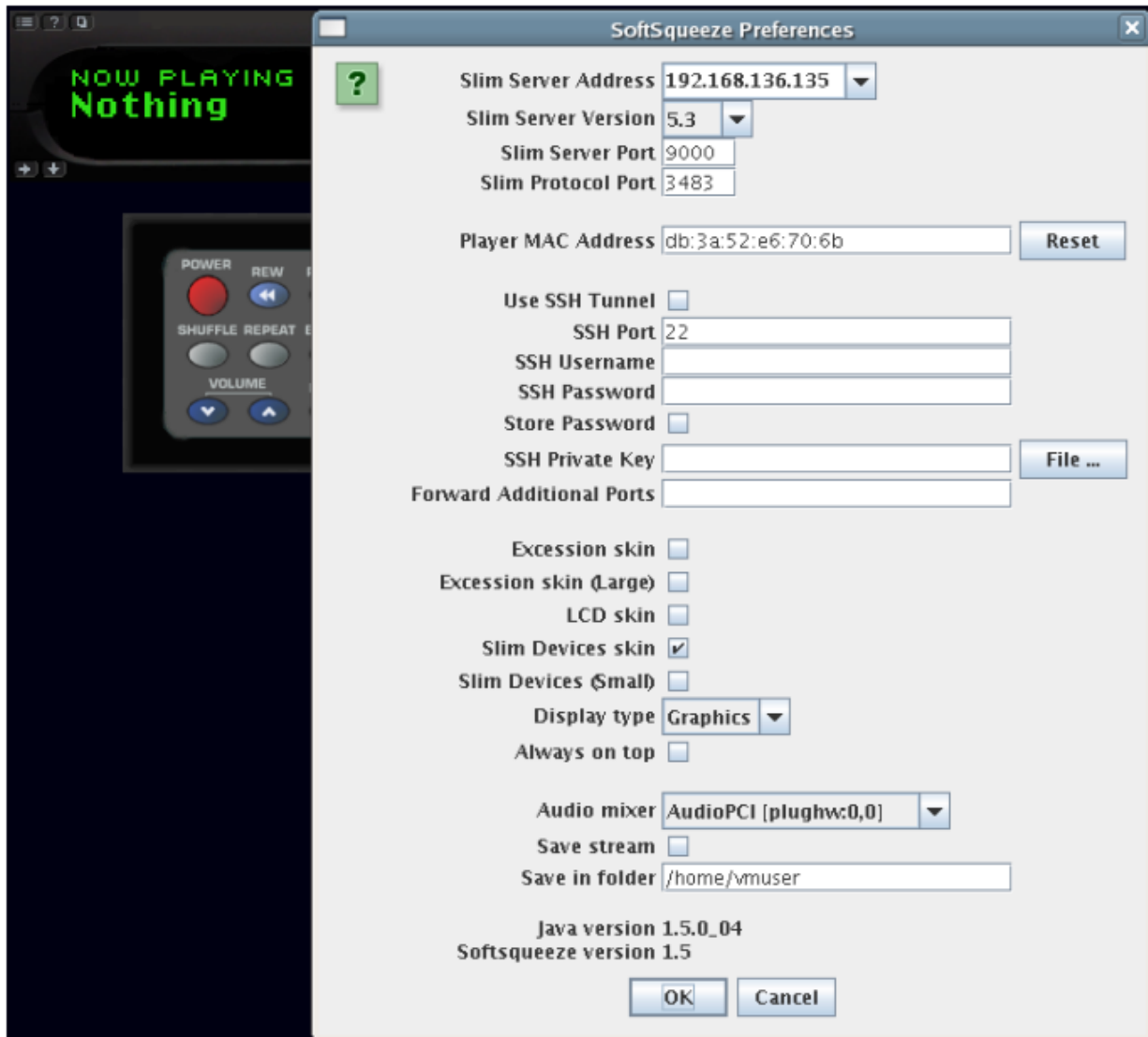
<input type="checkbox"/> d_server	Change
<input checked="" type="checkbox"/> d_slimproto	Change
<input checked="" type="checkbox"/> d_slimproto_v	Change
<input type="checkbox"/> d_source	Change

455. Start a network trace.

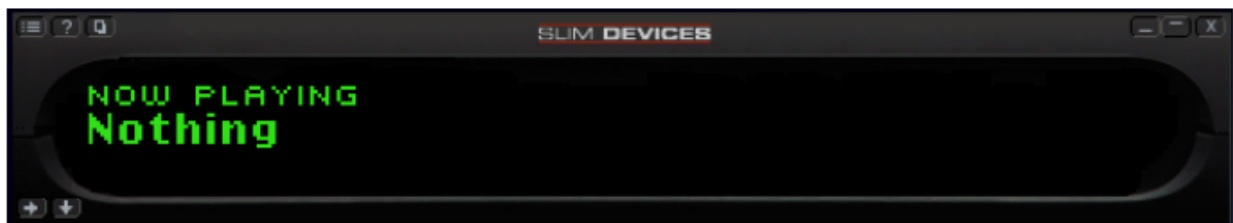
```
tcpdump -i eth0 -s 0 -w slimserver2-01.pcap
```

456. We then switch to slimserver2. On each player, press the settings icon at the top-left of the SoftSqueeze player to bring up the SoftSqueeze settings dialog. Configure the server to be slimserver2 (192.168.136.135). For example (player1):

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457. Do the same for player2 and player3. There is no need to power on player2 and player3 first. The SoftSqueeze settings can be configured without powering the players on. However, the players automatically power on when connected to slimserver2.



458. The Web UI for slimserver2 shows the players with IP addresses but no names.

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**SETTINGS**

- Server Settings
- Player Settings for 192.168.136.129
- Player Settings for 192.168.136.130
- Player Settings for 192.168.136.131

459. Configure the player names for player1, player2, and player3 as with slimserver1.

For example:

**Player Name**

You can give this player a name that will be used to identify the player on these web pages.

Player name:

460. Use the Web UI to power off all players. At this point, all players are persisted to slimserver1's preferences file with the defined names (player1, player2, and player3), power synchronization "off" (0), no sync groups, and power state "off" (0).

```
[vmuser@slimserver2 ~]$ grep -P 'playername|syncgroup|syncPower|power\b'
/etc/slimserver.conf
19:1e:67:04:72:30-playername = player2
19:1e:67:04:72:30-power = 0
19:1e:67:04:72:30-syncPower = 0
bc:2a:ae:6b:ab:ce-playername = player3
bc:2a:ae:6b:ab:ce-power = 0
bc:2a:ae:6b:ab:ce-syncPower = 0
db:3a:52:e6:70:6b-playername = player1
db:3a:52:e6:70:6b-power = 0
db:3a:52:e6:70:6b-syncPower = 0
```

461. We can now define the second synchrony group. Press the power button to power player1 back up and allow for interaction. The player briefly shows the welcome screen and then transitions to the home screen.

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462. Press up arrow to switch to the "Settings" menu item.



463. Press right arrow to select "Settings" and show the first Settings menu item ("Alarm Clock," setting 1 of 13).

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464. Press up arrow to switch to the "Synchronize" menu item (setting 13 of 13).



465. Press right arrow to select "Synchronize" and show a first synchronization choice (player3).

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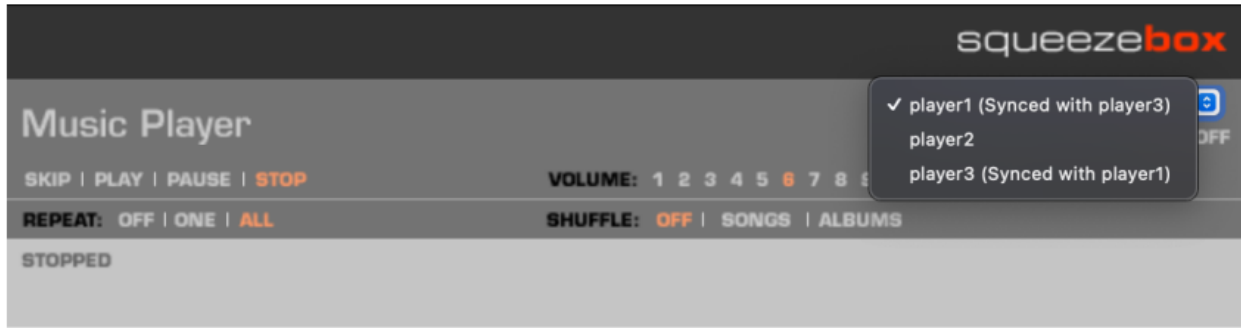


466. Press right arrow to select synchronization with player3. The screen changes to show that player3 is synced, with the menu choice now representing a choice to unsync.



467. The Web UI shows player1 and player3 synced. (Note: this screen shows player1 and player3 as synced even though player3 is off. This may be because synchronization was configured while player3 is off.)

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468. slimserver2's preferences file shows player1 and player3 defined in the same sync group (361890235). player1 is powered on. player2 and player3 are powered off.

```
[vmuser@slimserver2 ~]$ grep -P 'playername|syncgroup|syncPower|power\b'
/etc/slimserver.conf
19:1e:67:04:72:30-playername = player2
19:1e:67:04:72:30-power = 0
19:1e:67:04:72:30-syncPower = 0
bc:2a:ae:6b:ab:ce-playername = player3
bc:2a:ae:6b:ab:ce-power = 0
bc:2a:ae:6b:ab:ce-syncPower = 0
bc:2a:ae:6b:ab:ce-syncgroupid = 361890235
db:3a:52:e6:70:6b-playername = player1
db:3a:52:e6:70:6b-power = 1
db:3a:52:e6:70:6b-syncPower = 0
db:3a:52:e6:70:6b-syncgroupid = 361890235
```

469. We can now discuss the network messages for defining the second sync group. As shown above, synchronizing player1 with player3 involves a series of remote control inputs and player1 screens. Both the remote control inputs and resulting screens involve SlimProto network messages between slimserver1 and player1.

- player1 sends "IR " SlimProto messages to slimserver1 for each IR events, such as button presses.
- slimserver1 sends "grfd" SlimProto messages to to player1 to display graphical screens

470. We first identify the IR SlimProto messages, which send IR codes from the player to the SlimServer. From the identified IR messages, the last "right arrow" IR packet represents the "right arrow" button press that initiates sync for player1 and player3. The "right arrow" IR SlimProto packets are then identified using a WireShark display filter that selects for:

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destination port 3483 — from player to SlimServer  
 data that begins with "IR " — the IR type  
 data that has 0x7689d02f in the four bytes beginning at offset 14

471. Which is expressed as:

```
tcp.dstport == 3483 && data.data[0:4] == "IR " && data.data[14:4] == 76:89:d0:2f
```

472. There are six matching network packets, clustered in groups of two (13875/13889, 14486/14496, and 14872 /14882). Within a cluster, the packets occur very close in time (e.g., within 0.1 seconds for 13875/13889). Because the clustered IR packets are very close in time, an IR cluster is consistent with a button repeat sequence as handled by the SlimServer IR code.

Slim::Hardware::IR::processIR(), Slim/Hardware/IR.pm (v5.3.1), 334–393 at 365–376

473. The three clusters represent the three "right arrow" presses performed in the synchronization flow described above. The first "right arrow" selects the "Settings" menu item, the second "right arrow" selects the "Synchronize" menu item, and the third "right arrow" selects the sync group to join. The last IR packet cluster (14872 at 01:13:37.624794; 14882 at 01:31:37.717340) thereby represents the "arrow\_right" IR code that initiates the sync

tcp.dstport == 3483 && data.data[0:4] == "IR " && data.data[14:4] == 76:89:d0:2f							
No.	Time	Source	Destination	Protocol	Source Port	Destination Port	Length
13875	01:30:42.401868	192.168.136.129	192.168.136.135	TCP	32886	3483	84
13889	01:30:42.504236	192.168.136.129	192.168.136.135	TCP	32886	3483	84
14486	01:31:18.165704	192.168.136.129	192.168.136.135	TCP	32886	3483	84
14496	01:31:18.258447	192.168.136.129	192.168.136.135	TCP	32886	3483	84
14872	01:31:37.624794	192.168.136.129	192.168.136.135	TCP	32886	3483	84
14882	01:31:37.717340	192.168.136.129	192.168.136.135	TCP	32886	3483	84

474. The slimserver2 log file is consistent with the network trace (modulo a slight time skew between the network stack timestamp and the application logging timestamp).

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```
[vmuser@slimserver2 example]$ grep 'op IR ' slimserver2-01.log
2022-06-22 01:17:14.0381 Got Slimproto frame, op IR , length 10, IO::Socket::INET=GLOBAL(0x9c33b68)
2022-06-22 01:17:33.2673 Got Slimproto frame, op IR , length 10, IO::Socket::INET=GLOBAL(0x9c24f4c)
2022-06-22 01:17:49.8490 Got Slimproto frame, op IR , length 10, IO::Socket::INET=GLOBAL(0x9c14860)
2022-06-22 01:30:05.3874 Got Slimproto frame, op IR , length 10, IO::Socket::INET=GLOBAL(0x9c33b68)
2022-06-22 01:30:05.4790 Got Slimproto frame, op IR , length 10, IO::Socket::INET=GLOBAL(0x9c33b68)
2022-06-22 01:30:25.9373 Got Slimproto frame, op IR , length 10, IO::Socket::INET=GLOBAL(0x9c33b68)
2022-06-22 01:30:26.0287 Got Slimproto frame, op IR , length 10, IO::Socket::INET=GLOBAL(0x9c33b68)
2022-06-22 01:30:42.4033 Got Slimproto frame, op IR , length 10, IO::Socket::INET=GLOBAL(0x9c33b68)
2022-06-22 01:30:42.5056 Got Slimproto frame, op IR , length 10, IO::Socket::INET=GLOBAL(0x9c33b68)
2022-06-22 01:30:59.6879 Got Slimproto frame, op IR , length 10, IO::Socket::INET=GLOBAL(0x9c33b68)
2022-06-22 01:30:59.7800 Got Slimproto frame, op IR , length 10, IO::Socket::INET=GLOBAL(0x9c33b68)
2022-06-22 01:31:18.1667 Got Slimproto frame, op IR , length 10, IO::Socket::INET=GLOBAL(0x9c33b68)
2022-06-22 01:31:18.2595 Got Slimproto frame, op IR , length 10, IO::Socket::INET=GLOBAL(0x9c33b68)
2022-06-22 01:31:37.6259 Got Slimproto frame, op IR , length 10, IO::Socket::INET=GLOBAL(0x9c33b68)
2022-06-22 01:31:37.7183 Got Slimproto frame, op IR , length 10, IO::Socket::INET=GLOBAL(0x9c33b68)
```

475. After packet 14872 (01:13:37.624794), SlimServer responds with a series of eight 'grfd' command packets to the player animating the new screen pushing the old screen off to the left. See, e.g.: Slim::Player::SqueezeboxG::pushLeft(), Slim/Player/SqueezeboxG.pm (v5.3.1), 401–414 at 413; Slim::Player::SqueezeboxG::pushUpdate(), Slim/Player/SqueezeboxG.pm (v5.3.1), 447–464 at 459; Slim::Player::SqueezeboxG::drawFrameBuf(), Slim/Player/SqueezeboxG.pm (v5.3.1), 368–382 at 380.

476. Each such packet begins with a two-byte length field and a four-byte command field. The 'grfd' are identified in the network trace using a WireShark display filter that selects for: source port 3483 — from SlimServer to player; TCP length > 0 — to filter out pure acknowledgement packets; command code 'grfd'; destination 192.168.136.129 (player1).

```
tcp.srcport == 3483 && tcp.len > 0 && data.data[2:4] == "grfd" && ip.dst == 192.168.136.129
```

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tcp.srcport == 3483 && tcp.len > 0 && data.data[2:4] == "grfd" && ip.dst == 192.168.136.129							
No.	Time	Source	Destination	Protocol	Source Port	Destination Port	Length
14796	01:31:31.544339	192.168.136.135	192.168.136.129	TCP	3483	32886	634
14808	01:31:32.545144	192.168.136.135	192.168.136.129	TCP	3483	32886	634
14820	01:31:33.545706	192.168.136.135	192.168.136.129	TCP	3483	32886	634
14832	01:31:34.546145	192.168.136.135	192.168.136.129	TCP	3483	32886	634
14844	01:31:35.546841	192.168.136.135	192.168.136.129	TCP	3483	32886	634
14856	01:31:36.547260	192.168.136.135	192.168.136.129	TCP	3483	32886	634
14868	01:31:37.547797	192.168.136.135	192.168.136.129	TCP	3483	32886	634
14874	01:31:37.628768	192.168.136.135	192.168.136.129	TCP	3483	32886	634
14876	01:31:37.654575	192.168.136.135	192.168.136.129	TCP	3483	32886	634
14878	01:31:37.680275	192.168.136.135	192.168.136.129	TCP	3483	32886	634
14880	01:31:37.706544	192.168.136.135	192.168.136.129	TCP	3483	32886	634
14883	01:31:37.732211	192.168.136.135	192.168.136.129	TCP	3483	32886	634
14885	01:31:37.772730	192.168.136.135	192.168.136.129	TCP	3483	32886	634
14887	01:31:37.784182	192.168.136.135	192.168.136.129	TCP	3483	32886	634
14893	01:31:37.810231	192.168.136.135	192.168.136.129	TCP	3483	32886	634
14899	01:31:38.548328	192.168.136.135	192.168.136.129	TCP	3483	32886	634
14911	01:31:39.548866	192.168.136.135	192.168.136.129	TCP	3483	32886	634
14923	01:31:40.549496	192.168.136.135	192.168.136.129	TCP	3483	32886	634
14935	01:31:41.549951	192.168.136.135	192.168.136.129	TCP	3483	32886	634
14947	01:31:42.550553	192.168.136.135	192.168.136.129	TCP	3483	32886	634

477. The server sends a series of eight 'grfd' packets to player1 (192.168.136.129) starting at packet 14874 (01:31:37.628768) through packet 14893 (01:31:37.810231) with distinct contents, consistent with the "push left" animation. Packets 14505 (01:31:18.349026) through 14868 (01:31:37.547797) have identical 'grfd' payload, consistent with a repeated pre-sync screen:



478. For example, packet 14856 (01:31:36.547260):

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```

> Frame 14856: 634 bytes on wire (5072 bits), 634 bytes captured (5072 bits)
> Ethernet II, Src: VMware_3b:b5:d2 (00:0c:29:3b:b5:d2), Dst: VMware_45:6f:c2 (00:0c:29:45:6f:c2)
> Internet Protocol Version 4, Src: 192.168.136.135, Dst: 192.168.136.129
> Transmission Control Protocol, Src Port: 3483, Dst Port: 32886, Seq: 504607, Ack: 33049, Len: 568
> Data (568 bytes)

0000 00 0c 29 45 6f c2 00 0c 29 3b b5 d2 08 00 45 00  ..)Eo... );...E
0010 02 6c f6 1d 40 00 40 06 b0 14 c0 a8 88 87 c0 a8  .l...@.@. ....
0020 88 81 0d 9b 80 76 91 60 f9 da 7c 0a 51 9e 80 18  ....v`...|.Q...
0030 05 a8 94 b8 00 00 01 01 08 0a 02 ca e3 4c 02 6a  .......L.j
0040 11 ba 02 36 67 72 66 64 02 30 f8 7f a0 7f a0 24  ...6grfd .0.....$
0050 a0 44 40 7c 00 38 00 00 f8 00 a1 fe a1 fe a0 00  .D@|.8... ..
0060 58 00 00 0c 00 5e f8 52 a8 52 a8 7e 88 3e 00 00  X....^~R .R~>..
0070 00 00 48 60 a8 78 a8 3f a8 0c 90 30 00 40 00 00  .H`~x? ...0~@..
0080 48 00 a8 3c a8 7e a8 52 90 52 00 72 00 32 00 00  H~<~R .R.r.2..
0090 00 00 00 7e 00 7e 00 20 f8 60 a0 60 a0 00 a0 00  ....~.. ..
00a0 58 84 01 82 01 22 f9 fe 00 dc 00 00 70 00 88 00  X...."....p...
00b0 88 00 a8 00 b8 00 00 00 00 00 f8 00 20 00 20 00  ....f8 00 20 00
00c0 20 00 f8 00 00 00 00 00 80 00 80 00 f8 00 80 00  ....
00d0 80 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
00e0 80 00 80 00 f8 00 80 00 80 00 00 00 00 00 70 00  ....p
00f0 88 00 88 00 88 00 70 00 00 00 00 00 00 00 00  ....p
0100 00 00 00 00 00 00 48 00 a8 00 a8 00 a8 00 90 00  ....H
0110 00 00 00 00 80 00 40 00 38 00 40 00 80 00 00 00  ....@ 8~@
0120 00 00 f8 00 40 00 20 00 10 00 f8 00 00 00 00 00  ....@
0130 70 00 88 00 88 00 88 00 50 00 00 00 00 00 00 00  p.....P
0140 00 00 00 00 00 00 00 00 f0 00 08 00 08 00 f0 00  ....
0150 08 00 08 00 f0 00 00 00 00 00 f8 00 00 00 00 00  ....
0160 80 00 80 00 f8 00 80 00 80 00 00 00 00 00 f8 00  ....
0170 20 00 20 00 20 00 f8 00 00 00 00 00 48 00 00 00  . . . . .H
0180 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
0190 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
01a0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
01b0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
01c0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
01d0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
01e0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
01f0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
0200 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
0210 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
0220 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
0230 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
0240 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
0250 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
0260 00 00 00 00 00 00 00 70 00 70 00 70 00 70 01 fc  ....p .p.p.p
0270 00 f8 00 70 00 20 00 00 00  ....p

```

479. has the same 'grfd' payload as packet 14868 (01:31:37.547260):

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```

> Frame 14868: 634 bytes on wire (5072 bits), 634 bytes captured (5072 bits)
> Ethernet II, Src: VMware_3b:b5:d2 (00:0c:29:3b:b5:d2), Dst: VMware_45:6f:c2 (00:0c:29:45:6f:c2)
> Internet Protocol Version 4, Src: 192.168.136.135, Dst: 192.168.136.129
> Transmission Control Protocol, Src Port: 3483, Dst Port: 32886, Seq: 505175, Ack: 33087, Len: 568
> Data (568 bytes)
0000 00 0c 29 45 6f c2 00 0c 29 3b b5 d2 08 00 45 00 ..)Eo... );...E
0010 02 6c f6 21 40 00 40 06 b0 10 c0 a8 88 87 c0 a8 .l!@.@.....
0020 88 81 0d 9b 80 76 91 60 fc 12 7c 0a 51 c4 80 18 .....v`..|.Q...
0030 05 a8 94 b8 00 00 01 01 08 0a 02 ca e7 35 02 6a .....5.j
0040 15 a4 02 36 67 72 66 64 02 30 f8 7f a0 7f a0 24 ...6grfd.0....$
0050 a0 44 40 7c 00 38 00 00 f8 00 a1 fe a1 fe a0 00 .D@|.8..
0060 58 00 00 0c 00 5e f8 52 a8 52 a8 7e 88 3e 00 00 X....^R.R~>...
0070 00 00 48 60 a8 78 a8 3f a8 0c 90 30 00 40 00 00 .H`.x.?...0.@...
0080 48 00 a8 3c a8 7e a8 52 90 52 00 72 00 32 00 00 H<~R.R.r.2...
0090 00 00 00 7e 00 7e 00 20 f8 60 a0 60 a0 00 a0 00 .~..`..`.....
00a0 58 84 01 82 01 22 f9 fe 00 dc 00 00 70 00 88 00 X...."....p...
00b0 88 00 a8 00 b8 00 00 00 00 00 f8 00 20 00 20 00 .....
00c0 20 00 f8 00 00 00 00 00 80 00 80 00 f8 00 80 00 .....
00d0 80 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
00e0 80 00 80 00 f8 00 80 00 80 00 00 00 00 00 70 00 .....p.
00f0 88 00 88 00 88 00 70 00 00 00 00 00 00 00 00 .....p.
0100 00 00 00 00 00 00 48 00 a8 00 a8 00 a8 00 90 00 .....H.
0110 00 00 00 00 80 00 40 00 38 00 40 00 80 00 00 00 .....@.8@.....
0120 00 00 f8 00 40 00 20 00 10 00 f8 00 00 00 00 00 .....@.
0130 70 00 88 00 88 00 88 00 50 00 00 00 00 00 00 00 p.....P.....
0140 00 00 00 00 00 00 00 00 f0 00 08 00 08 00 f0 00 .....
0150 08 00 08 00 f0 00 00 00 00 00 f8 00 00 00 00 00 .....
0160 80 00 80 00 f8 00 80 00 80 00 00 00 00 00 f8 00 .....
0170 20 00 20 00 20 00 f8 00 00 00 00 00 48 00 00 00 . . . . .H...
0180 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
0190 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
01a0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
01b0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
01c0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
01d0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
01e0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
01f0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
0200 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
0210 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
0220 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
0230 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
0240 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
0250 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
0260 00 00 00 00 00 00 00 70 00 70 00 70 00 01 fc .....p.p.p.p..
0270 00 f8 00 70 00 20 00 00 00 00 .....p.

```

480. The payload for packets 14874 through 14893, shifting off old content and shifting in new content:

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```

> Frame 14874: 634 bytes on wire (5072 bits), 634 bytes captured (5072 bits)
> Ethernet II, Src: VMware_3b:b5:d2 (00:0c:29:3b:b5:d2), Dst: VMware_45:6f:c2 (00:0c:29:45:6f:c2)
> Internet Protocol Version 4, Src: 192.168.136.135, Dst: 192.168.136.129
> Transmission Control Protocol, Src Port: 3483, Dst Port: 32886, Seq: 505743, Ack: 33105, Len: 568
> Data (568 bytes)
0000 00 0c 29 45 6f c2 00 0c 29 3b b5 d2 08 00 45 00  ..)Eo... );...E
0010 02 6c f6 25 40 00 40 06 b0 0c c0 a8 88 87 c0 a8  .l.%@.@. ....
0020 88 81 0d 9b 80 76 91 60 fe 4a 7c 0a 51 d6 80 18  ....v` .J|.Q...
0030 05 a8 94 b8 00 00 01 01 08 0a 02 ca e7 86 02 6a  .........j
0040 18 45 02 36 67 72 66 64 02 30 00 00 00 7e 00 7e  .E.6grfd .0....~
0050 00 20 f8 60 a0 60 a0 00 a0 00 58 84 01 82 01 22  ..`.. .X...."
0060 f9 fe 00 dc 00 00 70 00 88 00 88 00 a8 00 b8 00  ....p.....
0070 00 00 00 00 f8 00 20 00 20 00 20 00 f8 00 00 00  .... . ....
0080 00 00 80 00 80 00 f8 00 80 00 80 00 00 00 00 00  ....
0090 00 00 00 00 00 00 00 00 00 00 80 00 80 00 f8 00  ....
00a0 80 00 80 00 00 00 00 00 70 00 88 00 88 00 88 00  .... p.....
00b0 70 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  p.....
00c0 48 00 a8 00 a8 00 a8 00 90 00 00 00 00 00 80 00  H.....
00d0 40 00 38 00 40 00 80 00 00 00 00 00 f8 00 40 00  @.8.@. ....@
00e0 20 00 10 00 f8 00 00 00 00 00 70 00 88 00 88 00  .... p.....
00f0 88 00 50 00 00 00 00 00 00 00 00 00 00 00 00 00  ..P.....
0100 00 00 f0 00 08 00 08 00 f0 00 08 00 08 00 f0 00  ....
0110 00 00 00 00 f8 00 00 00 00 00 80 00 80 00 f8 00  ....
0120 80 00 80 00 00 00 00 00 f8 00 20 00 20 00 20 00  ....
0130 f8 00 00 00 00 00 48 00 00 00 00 00 00 00 00  ....H. ....
0140 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
0150 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
0160 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
0170 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
0180 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
0190 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
01a0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
01b0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
01c0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
01d0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
01e0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
01f0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
0200 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
0210 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
0220 00 70 00 70 00 70 00 70 01 fc 00 f8 00 70 00 20  .p.p.p.p .....p
0230 00 00 00 00 f8 7f a0 7f a0 24 a0 44 40 7c 00 38  .... $D@|.8
0240 00 00 f8 00 a1 fe a1 fe a0 00 58 00 00 0c 00 5e  .... X....^
0250 f8 52 a8 52 a8 7e 88 3e 00 00 00 00 48 60 a8 78  .R.R.~> ....H`x
0260 a8 3f a8 0c 90 30 00 40 00 00 48 00 a8 3c a8 7e  .?...0@ ..H.<~
0270 a8 52 90 52 00 72 00 32 00 00  ....R.R.r.2 ..

```

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```

> Frame 14876: 634 bytes on wire (5072 bits), 634 bytes captured (5072 bits)
> Ethernet II, Src: VMware_3b:b5:d2 (00:0c:29:3b:b5:d2), Dst: VMware_45:6f:c2 (00:0c:29:45:6f:c2)
> Internet Protocol Version 4, Src: 192.168.136.135, Dst: 192.168.136.129
> Transmission Control Protocol, Src Port: 3483, Dst Port: 32886, Seq: 506311, Ack: 33105, Len: 568
> Data (568 bytes)
0000  00 0c 29 45 6f c2 00 0c 29 3b b5 d2 08 00 45 00  ..)Eo... );...E.
0010  02 6c f6 27 40 00 40 06 b0 0a c0 a8 88 87 c0 a8  .l.'@.@. ....
0020  88 81 0d 9b 80 76 91 61 00 82 7c 0a 51 d6 80 18  ....v.a ..|Q...
0030  05 a8 94 b8 00 00 01 01 08 0a 02 ca e7 a0 02 6a  .........j
0040  18 49 02 36 67 72 66 64 02 30 00 00 00 00 00 00  .I.6grfd .0.....
0050  00 00 00 00 80 00 80 00 f8 00 80 00 80 00 00 00  ....
0060  00 00 70 00 88 00 88 00 88 00 70 00 00 00 00 00  ..p..... .p.....
0070  00 00 00 00 00 00 00 00 00 00 48 00 a8 00 a8 00  .........H.....
0080  a8 00 90 00 00 00 00 00 80 00 40 00 38 00 40 00  .........@.8.@.
0090  80 00 00 00 00 00 00 f8 00 40 00 20 00 10 00 f8 00  .........@. ....
00a0  00 00 00 00 70 00 88 00 88 00 88 00 50 00 00 00  ....p... ..P...
00b0  00 00 00 00 00 00 00 00 00 00 00 00 f0 00 08 00  ....
00c0  08 00 f0 00 08 00 08 00 f0 00 00 00 00 00 f8 00  ....
00d0  00 00 00 00 80 00 80 00 f8 00 80 00 80 00 00 00  ....
00e0  00 00 f8 00 20 00 20 00 20 00 f8 00 00 00 00 00  ....
00f0  48 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  H.....
0100  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
0110  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
0120  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
0130  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
0140  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
0150  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
0160  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
0170  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
0180  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
0190  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
01a0  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
01b0  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
01c0  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
01d0  00 00 00 00 00 00 00 00 00 00 00 00 70 00 70 00 70  ....p.p.p
01e0  00 70 01 fc 00 f8 00 70 00 20 00 00 00 00 f8 7f  .p.....p .
01f0  a0 7f a0 24 a0 44 40 7c 00 38 00 00 f8 00 a1 fe  ...$.D@| .8.....
0200  a1 fe a0 00 58 00 00 0c 00 5e f8 52 a8 52 a8 7e  ...X... ^R.R~
0210  88 3e 00 00 00 00 48 60 a8 78 a8 3f a8 0c 90 30  >...H` .x?...0
0220  00 40 00 00 48 00 a8 3c a8 7e a8 52 90 52 00 72  @.H.< ~R.R.r
0230  00 32 00 00 00 00 00 7e 00 7e 00 20 f8 60 a0 60  .2.....~ ~.``
0240  a0 00 a0 00 58 84 01 82 01 22 f9 fe 00 dc 00 00  ...X... .".....
0250  70 00 88 00 88 00 a8 00 b8 00 00 00 00 00 f8 00  p.....
0260  20 00 20 00 20 00 f8 00 00 00 00 00 80 00 80 00  .
0270  f8 00 80 00 80 00 00 00 00 00

```

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```

> Frame 14878: 634 bytes on wire (5072 bits), 634 bytes captured (5072 bits)
> Ethernet II, Src: VMware_3b:b5:d2 (00:0c:29:3b:b5:d2), Dst: VMware_45:6f:c2 (00:0c:29:45:6f:c2)
> Internet Protocol Version 4, Src: 192.168.136.135, Dst: 192.168.136.129
> Transmission Control Protocol, Src Port: 3483, Dst Port: 32886, Seq: 506879, Ack: 33105, Len: 568
> Data (568 bytes)

0000 00 0c 29 45 6f c2 00 0c 29 3b b5 d2 08 00 45 00  ..)Eo... );...E.
0010 02 6c f6 29 40 00 40 06 b0 08 c0 a8 88 87 c0 a8  .L.)@.@. ....
0020 88 81 0d 9b 80 76 91 61 02 ba 7c 0a 51 d6 80 18  ....v.a ..|Q...
0030 05 a8 94 b8 00 00 01 01 08 0a 02 ca e7 ba 02 6a  .........j
0040 18 63 02 36 67 72 66 64 02 30 80 00 00 00 00 00  .c.6grfd .0.....
0050 f8 00 40 00 20 00 10 00 f8 00 00 00 00 00 70 00  .@. ... ..p.
0060 88 00 88 00 88 00 50 00 00 00 00 00 00 00 00 00  ....P. ....
0070 00 00 00 00 00 00 f0 00 08 00 08 00 f0 00 08 00  ....
0080 08 00 f0 00 00 00 00 00 f8 00 00 00 00 00 80 00  ....
0090 80 00 f8 00 80 00 80 00 00 00 00 00 f8 00 20 00  ....
00a0 20 00 20 00 f8 00 00 00 00 00 48 00 00 00 00 00  . ....H....
00b0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
00c0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
00d0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
00e0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
00f0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
0100 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
0110 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
0120 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
0130 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
0140 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
0150 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
0160 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
0170 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
0180 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
0190 00 00 00 00 00 00 70 00 70 00 70 01 fc 00 f8  ....p.p .p.p...
01a0 00 70 00 20 00 00 00 00 f8 7f a0 7f a0 24 a0 44  .p. ....$.D
01b0 40 7c 00 38 00 00 f8 00 a1 fe a1 fe a0 00 58 00  @|.8....X.
01c0 00 0c 00 5e f8 52 a8 52 a8 7e 88 3e 00 00 00 00  ....^R.R ~>...
01d0 48 60 a8 78 a8 3f a8 0c 90 30 00 40 00 00 48 00  H`x.?..0.@.H.
01e0 a8 3c a8 7e a8 52 90 52 00 72 00 32 00 00 00 00  <~R.R .r.2...
01f0 00 7e 00 7e 00 20 f8 60 a0 60 a0 00 a0 00 58 84  ~~~. `.`...X.
0200 01 82 01 22 f9 fe 00 dc 00 00 70 00 88 00 88 00  ...". ...p....
0210 a8 00 b8 00 00 00 00 00 f8 00 20 00 20 00 20 00  ....
0220 f8 00 00 00 00 00 80 00 80 00 f8 00 80 00 80 00  ....
0230 00 00 00 00 00 00 00 00 00 00 00 00 00 80 00  ....
0240 80 00 f8 00 80 00 80 00 00 00 00 00 70 00 88 00  ....p...
0250 88 00 88 00 70 00 00 00 00 00 00 00 00 00 00 00  ....p....
0260 00 00 00 00 f0 00 08 00 08 00 08 00 f0 00 00 00  ....
0270 00 00 f8 00 40 00 20 00 10 00  ....@. ...

```

Contains Highly Confidential AEO and Source Code Materials

```

> Frame 14880: 634 bytes on wire (5072 bits), 634 bytes captured (5072 bits)
> Ethernet II, Src: VMware_3b:b5:d2 (00:0c:29:3b:b5:d2), Dst: VMware_45:6f:c2 (00:0c:29:45:6f:c2)
> Internet Protocol Version 4, Src: 192.168.136.135, Dst: 192.168.136.129
> Transmission Control Protocol, Src Port: 3483, Dst Port: 32886, Seq: 507447, Ack: 33105, Len: 568
> Data (568 bytes)
0000  00 0c 29 45 6f c2 00 0c 29 3b b5 d2 08 00 45 00  ..)Eo...);...E.
0010  02 6c f6 2b 40 00 40 06 b0 06 c0 a8 88 87 c0 a8  .l.+@.@.....
0020  88 81 0d 9b 80 76 91 61 04 f2 7c 0a 51 d6 80 18  ....v.a...|Q...
0030  05 a8 94 b8 00 00 01 01 08 0a 02 ca e7 d4 02 6a  .........j
0040  18 7d 02 36 67 72 66 64 02 30 80 00 f8 00 80 00  .}.6grfd..0.....
0050  80 00 00 00 00 00 f8 00 20 00 20 00 20 00 f8 00  .....
0060  00 00 00 00 48 00 00 00 00 00 00 00 00 00 00 00  ....H.....
0070  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  .....
0080  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  .....
0090  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  .....
00a0  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  .....
00b0  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  .....
00c0  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  .....
00d0  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  .....
00e0  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  .....
00f0  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  .....
0100  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  .....
0110  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  .....
0120  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  .....
0130  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  .....
0140  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 70  .....p
0150  00 70 00 70 00 70 01 fc 00 f8 00 70 00 20 00 00  .p.p.p...p...
0160  00 00 f8 7f a0 7f a0 24 a0 44 40 7c 00 38 00 00  ....$D@|.8..
0170  f8 00 a1 fe a1 fe a0 00 58 00 00 0c 00 5e f8 52  ....X....^R
0180  a8 52 a8 7e 88 3e 00 00 00 00 48 60 a8 78 a8 3f  .R~>...H`x.?
0190  a8 0c 90 30 00 40 00 00 48 00 a8 3c a8 7e a8 52  ...0.@.H<~R
01a0  90 52 00 72 00 32 00 00 00 00 00 00 7e 00 7e 00  .R.r.2...~.
01b0  f8 60 a0 60 a0 00 a0 00 58 84 01 82 01 22 f9 fe  .`.....X...."
01c0  00 dc 00 00 70 00 88 00 88 00 a8 00 b8 00 00 00  ....p.....
01d0  00 00 f8 00 20 00 20 00 20 00 f8 00 00 00 00 00  ....
01e0  80 00 80 00 f8 00 80 00 80 00 00 00 00 00 00 00  .....
01f0  00 00 00 00 00 00 00 00 80 00 80 00 f8 00 80 00  .....
0200  80 00 00 00 00 00 70 00 88 00 88 00 88 00 70 00  ....p.....p
0210  00 00 00 00 00 00 00 00 00 00 00 00 00 f0 00  .....
0220  08 00 08 00 08 00 f0 00 00 00 00 00 f8 00 40 00  .....@
0230  20 00 10 00 f8 00 00 00 00 00 48 00 a8 00 a8 00  ....H.....
0240  a8 00 90 00 00 00 00 00 80 00 40 00 38 00 40 00  ....@8.@
0250  80 00 00 00 00 00 f8 00 40 00 20 00 10 00 f8 00  ....@.....
0260  00 00 00 00 70 00 88 00 88 00 88 00 50 00 00 00  ....p.....P
0270  00 00 00 00 00 00 00 00 00 00

```

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```

> Frame 14883: 634 bytes on wire (5072 bits), 634 bytes captured (5072 bits)
> Ethernet II, Src: VMware_3b:b5:d2 (00:0c:29:3b:b5:d2), Dst: VMware_45:6f:c2 (00:0c:29:45:6f:c2)
> Internet Protocol Version 4, Src: 192.168.136.135, Dst: 192.168.136.129
> Transmission Control Protocol, Src Port: 3483, Dst Port: 32886, Seq: 508015, Ack: 33123, Len: 568
> Data (568 bytes)
0000 00 0c 29 45 6f c2 00 0c 29 3b b5 d2 08 00 45 00 ..)Eo... );...E
0010 02 6c f6 2d 40 00 40 06 b0 04 c0 a8 88 87 c0 a8 .l-@.@. ....
0020 88 81 0d 9b 80 76 91 61 07 2a 7c 0a 51 e8 80 18 ....v.a *|.Q..
0030 05 a8 94 b8 00 00 01 01 08 0a 02 ca e7 ee 02 6a .....j
0040 18 a1 02 36 67 72 66 64 02 30 00 00 00 00 00 00 ..6grfd .0.....
0050 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
0060 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
0070 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
0080 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
0090 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
00a0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
00b0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
00c0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
00d0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
00e0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
00f0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
0100 00 00 00 00 00 00 00 00 00 70 00 70 00 70 00 .....p.p.p.p
0110 01 fc 00 f8 00 70 00 20 00 00 00 00 f8 7f a0 7f .....p
0120 a0 24 a0 44 40 7c 00 38 00 00 f8 00 a1 fe a1 fe ..$.D@|.8 .....
0130 a0 00 58 00 00 0c 00 5e f8 52 a8 52 a8 7e 88 3e ..X....^ .R.R.~>
0140 00 00 00 00 48 60 a8 78 a8 3f a8 0c 90 30 00 40 ....H`x .?..0.@
0150 00 00 48 00 a8 3c a8 7e a8 52 90 52 00 72 00 32 ..H.<~ .R.R.r.2
0160 00 00 00 00 00 7e 00 7e 00 20 f8 60 a0 60 a0 00 .....~.. .`..
0170 a0 00 58 84 01 82 01 22 f9 fe 00 dc 00 00 70 00 ..X...." .....p
0180 88 00 88 00 a8 00 b8 00 00 00 00 00 f8 00 20 00 .....
0190 20 00 20 00 f8 00 00 00 00 00 80 00 80 00 f8 00 .....
01a0 80 00 80 00 00 00 00 00 00 00 00 00 00 00 00 .....
01b0 00 00 80 00 80 00 f8 00 80 00 80 00 00 00 00 .....
01c0 70 00 88 00 88 00 88 00 70 00 00 00 00 00 00 p.....p.....
01d0 00 00 00 00 00 00 00 00 f0 00 08 00 08 00 08 00 .....
01e0 f0 00 00 00 00 00 f8 00 40 00 20 00 10 00 f8 00 .....@.....
01f0 00 00 00 00 48 00 a8 00 a8 00 a8 00 90 00 00 00 ....H.....
0200 00 00 80 00 40 00 38 00 40 00 80 00 00 00 00 00 ....@.8. @.....
0210 f8 00 40 00 20 00 10 00 f8 00 00 00 00 00 70 00 ..@. .p.....
0220 88 00 88 00 88 00 50 00 00 00 00 00 00 00 00 .....P.....
0230 00 00 00 00 00 00 f0 00 08 00 08 00 f0 00 08 00 .....
0240 08 00 f0 00 00 00 00 00 f8 00 00 00 00 00 80 00 .....
0250 80 00 f8 00 80 00 80 00 00 00 00 00 f8 00 20 00 .....
0260 20 00 20 00 f8 00 00 00 00 00 48 00 00 00 00 00 .....H.....
0270 00 00 00 00 00 00 00 00 00 00

```

## Contains Highly Confidential AEO and Source Code Materials

```

> Frame 14885: 634 bytes on wire (5072 bits), 634 bytes captured (5072 bits)
> Ethernet II, Src: VMware_3b:b5:d2 (00:0c:29:3b:b5:d2), Dst: VMware_45:6f:c2 (00:0c:29:45:6f:c2)
> Internet Protocol Version 4, Src: 192.168.136.135, Dst: 192.168.136.129
> Transmission Control Protocol, Src Port: 3483, Dst Port: 32886, Seq: 508583, Ack: 33123, Len: 568
> Data (568 bytes)
0000 00 0c 29 45 6f c2 00 0c 29 3b b5 d2 08 00 45 00  ..)Eo... );...E.
0010 02 6c f6 2f 40 00 40 06 b0 02 c0 a8 88 87 c0 a8  .l./@.@. ....
0020 88 81 0d 9b 80 76 91 61 09 62 7c 0a 51 e8 80 18  ....v.a .b|.Q...
0030 05 a8 94 b8 00 00 01 01 08 0a 02 ca e8 16 02 6a  .........j
0040 18 d9 02 36 67 72 66 64 02 30 00 00 00 00 00 00  ..6grfd .0.....
0050 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
0060 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
0070 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
0080 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
0090 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
00a0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
00b0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
00c0 00 00 00 70 00 70 00 70 00 70 01 fc 00 f8 00 70  ...p.p.p .p....p
00d0 00 20 00 00 00 00 f8 7f a0 7f a0 24 a0 44 40 7c  ....$.D@|
00e0 00 38 00 00 f8 00 a1 fe a1 fe a0 00 58 00 00 0c  .8.....X...
00f0 00 5e f8 52 a8 52 a8 7e 88 3e 00 00 00 00 48 60  ^~R.R~>....H`
0100 a8 78 a8 3f a8 0c 90 30 00 40 00 00 48 00 a8 3c  .x.?...0 .@..H..<
0110 a8 7e a8 52 90 52 00 72 00 32 00 00 00 00 00 7e  ~R.R.r .2.....~
0120 00 7e 00 20 f8 60 a0 60 a0 00 a0 00 58 84 01 82  ~.``.X...
0130 01 22 f9 fe 00 dc 00 00 70 00 88 00 88 00 a8 00  .".....p.....
0140 b8 00 00 00 00 00 f8 00 20 00 20 00 20 00 f8 00  ....
0150 00 00 00 00 80 00 80 00 f8 00 80 00 80 00 00 00  ....
0160 00 00 00 00 00 00 00 00 00 00 00 00 80 00 80 00  ....
0170 f8 00 80 00 80 00 00 00 00 00 70 00 88 00 88 00  ....p.....
0180 88 00 70 00 00 00 00 00 00 00 00 00 00 00 00  ..p.....
0190 00 00 f0 00 08 00 08 00 08 00 f0 00 00 00 00 00  ....
01a0 f8 00 40 00 20 00 10 00 f8 00 00 00 00 00 48 00  ..@. ....H.
01b0 a8 00 a8 00 a8 00 90 00 00 00 00 00 80 00 40 00  ....@.
01c0 38 00 40 00 80 00 00 00 00 00 f8 00 40 00 20 00  8.@.....@.
01d0 10 00 f8 00 00 00 00 00 70 00 88 00 88 00 88 00  ....p.....
01e0 50 00 00 00 00 00 00 00 00 00 00 00 00 00 00  P.....
01f0 f0 00 08 00 08 00 f0 00 08 00 08 00 f0 00 00 00  ....
0200 00 00 f8 00 00 00 00 00 80 00 80 00 f8 00 80 00  ....
0210 80 00 00 00 00 00 f8 00 20 00 20 00 20 00 f8 00  ....
0220 00 00 00 00 48 00 00 00 00 00 00 00 00 00 00  ....H...
0230 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
0240 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
0250 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
0260 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
0270 00 00 00 00 00 00 00 00 00 00  ..

```

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```

> Frame 14887: 634 bytes on wire (5072 bits), 634 bytes captured (5072 bits)
> Ethernet II, Src: VMware_3b:b5:d2 (00:0c:29:3b:b5:d2), Dst: VMware_45:6f:c2 (00:0c:29:45:6f:c2)
> Internet Protocol Version 4, Src: 192.168.136.135, Dst: 192.168.136.129
> Transmission Control Protocol, Src Port: 3483, Dst Port: 32886, Seq: 509151, Ack: 33123, Len: 568
> Data (568 bytes)
0000  00 0c 29 45 6f c2 00 0c 29 3b b5 d2 08 00 45 00  ..)Eo... );...E.
0010  02 6c f6 31 40 00 40 06 b0 00 c0 a8 88 87 c0 a8  .l.1@.@. ....
0020  88 81 0d 9b 80 76 91 61 0b 9a 7c 0a 51 e8 80 18  ....v.a ..|Q...
0030  05 a8 94 b8 00 00 01 01 08 0a 02 ca e8 22 02 6a  .......".j
0040  18 d9 02 36 67 72 66 64 02 30 00 00 00 00 00 00  ..6grfd .0.....
0050  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
0060  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
0070  00 00 00 00 00 00 00 00 00 00 00 00 70 00 70  ....p.p
0080  00 70 00 70 01 fc 00 f8 00 70 00 20 00 00 00 00  .p.p....p....
0090  f8 7f a0 7f a0 24 a0 44 40 7c 00 38 00 00 f8 00  ....$.D @|.8....
00a0  a1 fe a1 fe a0 00 58 00 00 0c 00 5e f8 52 a8 52  ....X. ...^..R
00b0  a8 7e 88 3e 00 00 00 00 48 60 a8 78 a8 3f a8 0c  ~>....H`x.?..
00c0  90 30 00 40 00 00 48 00 a8 3c a8 7e a8 52 90 52  .0.@..H. <~..R
00d0  00 72 00 32 00 00 00 00 00 7e 00 7e 00 20 f8 60  .r.2....~..`
00e0  a0 60 a0 00 a0 00 58 84 01 82 01 22 f9 fe 00 dc  .X. ...."....
00f0  00 00 70 00 88 00 88 00 a8 00 b8 00 00 00 00 00  .p....
0100  f8 00 20 00 20 00 20 00 f8 00 00 00 00 00 80 00  . . . .
0110  80 00 f8 00 80 00 80 00 00 00 00 00 00 00 00  ....
0120  00 00 00 00 00 00 80 00 80 00 f8 00 80 00 80 00  ....
0130  00 00 00 00 70 00 88 00 88 00 88 00 70 00 00 00  ....p....p...
0140  00 00 00 00 00 00 00 00 00 00 00 00 f0 00 08 00  ....
0150  08 00 08 00 f0 00 00 00 00 00 f8 00 40 00 20 00  ....@.
0160  10 00 f8 00 00 00 00 00 48 00 a8 00 a8 00 a8 00  ....H.
0170  90 00 00 00 00 00 80 00 40 00 38 00 40 00 80 00  ....@.8.@...
0180  00 00 00 00 f8 00 40 00 20 00 10 00 f8 00 00 00  ....@.
0190  00 00 70 00 88 00 88 00 88 00 50 00 00 00 00 00  .p....P....
01a0  00 00 00 00 00 00 00 00 00 00 f0 00 08 00 08 00  ....
01b0  f0 00 08 00 08 00 f0 00 00 00 00 00 f8 00 00 00  ....
01c0  00 00 80 00 80 00 f8 00 80 00 80 00 00 00 00 00  ....
01d0  f8 00 20 00 20 00 20 00 f8 00 00 00 00 00 48 00  . . . .H.
01e0  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
01f0  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
0200  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
0210  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
0220  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
0230  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
0240  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
0250  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
0260  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
0270  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ..

```

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```

> Frame 14893: 634 bytes on wire (5072 bits), 634 bytes captured (5072 bits)
> Ethernet II, Src: VMware_3b:b5:d2 (00:0c:29:3b:b5:d2), Dst: VMware_45:6f:c2 (00:0c:29:45:6f:c2)
> Internet Protocol Version 4, Src: 192.168.136.135, Dst: 192.168.136.129
> Transmission Control Protocol, Src Port: 3483, Dst Port: 32886, Seq: 509719, Ack: 33123, Len: 568
> Data (568 bytes)
0000 00 0c 29 45 6f c2 00 0c 29 3b b5 d2 08 00 45 00 ..)Eo...);...E.
0010 02 6c f6 33 40 00 40 06 af fe c0 a8 88 87 c0 a8 .l.3@.@. ....
0020 88 81 0d 9b 80 76 91 61 0d d2 7c 0a 51 e8 80 18 ....v.a..|.Q...
0030 05 a8 94 b8 00 00 01 01 08 0a 02 ca e8 3c 02 6a ....<.j
0040 18 e5 02 36 67 72 66 64 02 30 f8 7f a0 7f a0 24 ..6grfd..0....$
0050 a0 44 40 7c 00 38 00 00 f8 00 a1 fe a1 fe a0 00 .De|.8.. ....
0060 58 00 00 0c 00 5e f8 52 a8 52 a8 7e 88 3e 00 00 X....^..R..R~>..
0070 00 00 48 60 a8 78 a8 3f a8 0c 90 30 00 40 00 00 ..H`.x.?...0.@..
0080 48 00 a8 3c a8 7e a8 52 90 52 00 72 00 32 00 00 H.<~..R..R.r.2..
0090 00 00 00 7e 00 7e 00 20 f8 60 a0 60 a0 00 a0 00 ....~..`..`..2..
00a0 58 84 01 82 01 22 f9 fe 00 dc 00 00 70 00 88 00 X...."....p...
00b0 88 00 a8 00 b8 00 00 00 00 00 f8 00 20 00 20 00 .....
00c0 20 00 f8 00 00 00 00 00 80 00 80 00 f8 00 80 00 .....
00d0 80 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
00e0 80 00 80 00 f8 00 80 00 80 00 00 00 00 70 00 .....p.
00f0 88 00 88 00 88 00 70 00 00 00 00 00 00 00 00 .....p.
0100 00 00 00 00 00 00 f0 00 08 00 08 00 08 00 f0 00 .....
0110 00 00 00 00 f8 00 40 00 20 00 10 00 f8 00 00 00 .....@.
0120 00 00 48 00 a8 00 a8 00 a8 00 90 00 00 00 00 00 ..H.....
0130 80 00 40 00 38 00 40 00 80 00 00 00 00 00 f8 00 ..@.8.@.
0140 40 00 20 00 10 00 f8 00 00 00 00 00 70 00 88 00 @.....p...
0150 88 00 88 00 50 00 00 00 00 00 00 00 00 00 00 ....P.....
0160 00 00 00 00 f0 00 08 00 08 00 f0 00 08 00 08 00 .....
0170 f0 00 00 00 00 00 f8 00 00 00 00 00 80 00 80 00 .....
0180 f8 00 80 00 80 00 00 00 00 00 f8 00 20 00 20 00 .....
0190 20 00 f8 00 00 00 00 00 48 00 00 00 00 00 00 00 .....H.....
01a0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
01b0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
01c0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
01d0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
01e0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
01f0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
0200 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
0210 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
0220 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
0230 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
0240 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
0250 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
0260 00 00 00 00 00 00 70 00 70 00 70 00 01 fc .....p.p.p.p.
0270 00 f8 00 70 00 20 00 00 00 00 .....p.

```

481. Packets 14899 through 15094 (the last 'grfd' packet in the trace) contain the same 'grfd' payload as packet 14893. For example, packet 14899:

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```
> Frame 14899: 634 bytes on wire (5072 bits), 634 bytes captured (5072 bits)
> Ethernet II, Src: VMware_3b:b5:d2 (00:0c:29:3b:b5:d2), Dst: VMware_45:6f:c2 (00:0c:29:45:6f:c2)
> Internet Protocol Version 4, Src: 192.168.136.135, Dst: 192.168.136.129
> Transmission Control Protocol, Src Port: 3483, Dst Port: 32886, Seq: 510287, Ack: 33161, Len: 568
> Data (568 bytes)

0000 00 0c 29 45 6f c2 00 0c 29 3b b5 d2 08 00 45 00  ..)Eo... );...E-
0010 02 6c f6 37 40 00 40 06 af fa c0 a8 88 87 c0 a8  .l.7@.@ .....
0020 88 81 0d 9b 80 76 91 61 10 0a 7c 0a 52 0e 80 18  ....v.a...|.R...
0030 05 a8 94 b8 00 00 01 01 08 0a 02 ca eb 1e 02 6a  ....j
0040 19 8e 02 36 67 72 66 64 02 30 f8 7f a0 7f a0 24  ..6grfd.0.....$
0050 a0 44 40 7c 00 38 00 00 f8 00 a1 fe a1 fe a0 00  .D@|.8.....
0060 58 00 00 0c 00 5e f8 52 a8 52 a8 7e 88 3e 00 00  X.....^R.R.~>..
0070 00 00 48 60 a8 78 a8 3f a8 0c 90 30 00 40 00 00  .H`.x.?...0.@..
0080 48 00 a8 3c a8 7e a8 52 90 52 00 72 00 32 00 00  H.<~R.R.r.2...
0090 00 00 00 7e 00 7e 00 20 f8 60 a0 60 a0 00 a0 00  .~..~..`.....
00a0 58 84 01 82 01 22 f9 fe 00 dc 00 00 70 00 88 00  X.....".....p...
00b0 88 00 a8 00 b8 00 00 00 00 00 f8 00 20 00 20 00  .....
00c0 20 00 f8 00 00 00 00 00 80 00 80 00 f8 00 80 00  .....
00d0 80 00 00 00 00 00 00 00 00 00 00 00 00 00 00  .....
00e0 80 00 80 00 f8 00 80 00 80 00 00 00 00 00 70 00  .....p.
00f0 88 00 88 00 88 00 70 00 00 00 00 00 00 00 00  .....p.
0100 00 00 00 00 00 00 f0 00 08 00 08 00 08 00 f0 00  .....@.
0110 00 00 00 00 f8 00 40 00 20 00 10 00 f8 00 00 00  .....H.....
0120 00 00 48 00 a8 00 a8 00 a8 00 90 00 00 00 00 00  .@.8@.....
0130 80 00 40 00 38 00 40 00 80 00 00 00 00 00 f8 00  @.....p...
0140 40 00 20 00 10 00 f8 00 00 00 00 00 70 00 88 00  @.....P...
0150 88 00 88 00 50 00 00 00 00 00 00 00 00 00 00  ....P.....
0160 00 00 00 00 f0 00 08 00 08 00 f0 00 08 00 08 00  .....
0170 f0 00 00 00 00 00 f8 00 00 00 00 00 80 00 80 00  .....
0180 f8 00 80 00 80 00 00 00 00 00 f8 00 20 00 20 00  .....
0190 20 00 f8 00 00 00 00 00 48 00 00 00 00 00 00 00  .....H.....
01a0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  .....
01b0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  .....
01c0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  .....
01d0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  .....
01e0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  .....
01f0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  .....
0200 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  .....
0210 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  .....
0220 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  .....
0230 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  .....
0240 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  .....
0250 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  .....
0260 00 00 00 00 00 00 00 70 00 70 00 70 00 70 01 fc  ....p.p.p.p...
0270 00 f8 00 70 00 20 00 00 00 00  ..p. . . .
```

482. The slimserver2 log entries are consistent with the network trace. Filtering the slimserver2 shows player-to-server IR codes and server-to-player SlimProto frames:

```
grep -P 'op IR |sending squeezebox frame' slimserver2-01.log
```

483. The filtered results show a last IR packet cluster at 01:31:37.6259 and 01:31:37.7183, representing the "right arrow" that initiates the sync. There are eight 'grfd' messages following the 01:31:37.6259 IR packet, with the eighth 'grfd' packet at 01:31:37.7886.

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The timestamp for that eighth 'grfd' packet (01:31:37.7886) is consistent with the network timestamp for packet 14893 (01:31:37.810231), modulo skew between the application logging and network timestamps.

```

2022-06-22 01:31:37.3184 sending squeezebox frame: grfd, length: 562
2022-06-22 01:31:37.5477 sending squeezebox frame: grfd, length: 562
2022-06-22 01:31:37.6259 Got Slimproto frame, op IR , length 10, IO::Socket::INET=GLOBAL(0x9c33b68)
2022-06-22 01:31:37.6287 sending squeezebox frame: grfd, length: 562
2022-06-22 01:31:37.6543 sending squeezebox frame: grfd, length: 562
2022-06-22 01:31:37.6801 sending squeezebox frame: grfd, length: 562
2022-06-22 01:31:37.7062 sending squeezebox frame: grfd, length: 562
2022-06-22 01:31:37.7183 Got Slimproto frame, op IR , length 10, IO::Socket::INET=GLOBAL(0x9c33b68)
2022-06-22 01:31:37.7321 sending squeezebox frame: grfd, length: 562
2022-06-22 01:31:37.7582 sending squeezebox frame: grfd, length: 562
2022-06-22 01:31:37.7841 sending squeezebox frame: grfd, length: 562
2022-06-22 01:31:37.7886 sending squeezebox frame: grfd, length: 562
2022-06-22 01:31:37.8101 sending squeezebox frame: grfd, length: 562
2022-06-22 01:31:38.3184 sending squeezebox frame: grfd, length: 562

```

484. Consequently, packet 14893 (01:31:37.810231) represents the 'grfd' message sent from slimserver2 to player1 with the post-sync screen:



485. We can now play music on player1 through slimserver2. After synchronizing player1 with player3, player1 is on while player2 and player3 are off.

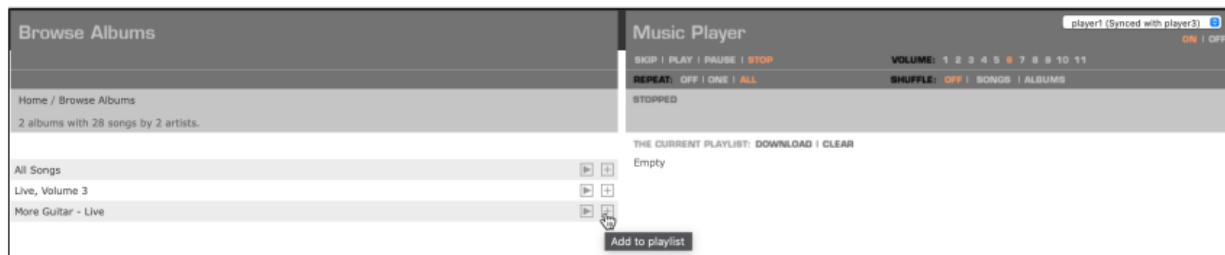
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```
[vmuser@slimserver2 ~]$ grep -P 'playername|syncgroup|syncPower|power\b'
/etc/slimserver.conf
19:1e:67:04:72:30-playername = player2
19:1e:67:04:72:30-power = 0
19:1e:67:04:72:30-syncPower = 0
bc:2a:ae:6b:ab:ce-playername = player3
bc:2a:ae:6b:ab:ce-power = 0
bc:2a:ae:6b:ab:ce-syncPower = 0
bc:2a:ae:6b:ab:ce-syncgroupid = 361890235
db:3a:52:e6:70:6b-playername = player1
db:3a:52:e6:70:6b-power = 1
db:3a:52:e6:70:6b-syncPower = 0
db:3a:52:e6:70:6b-syncgroupid = 361890235
```

486. Start a network trace:

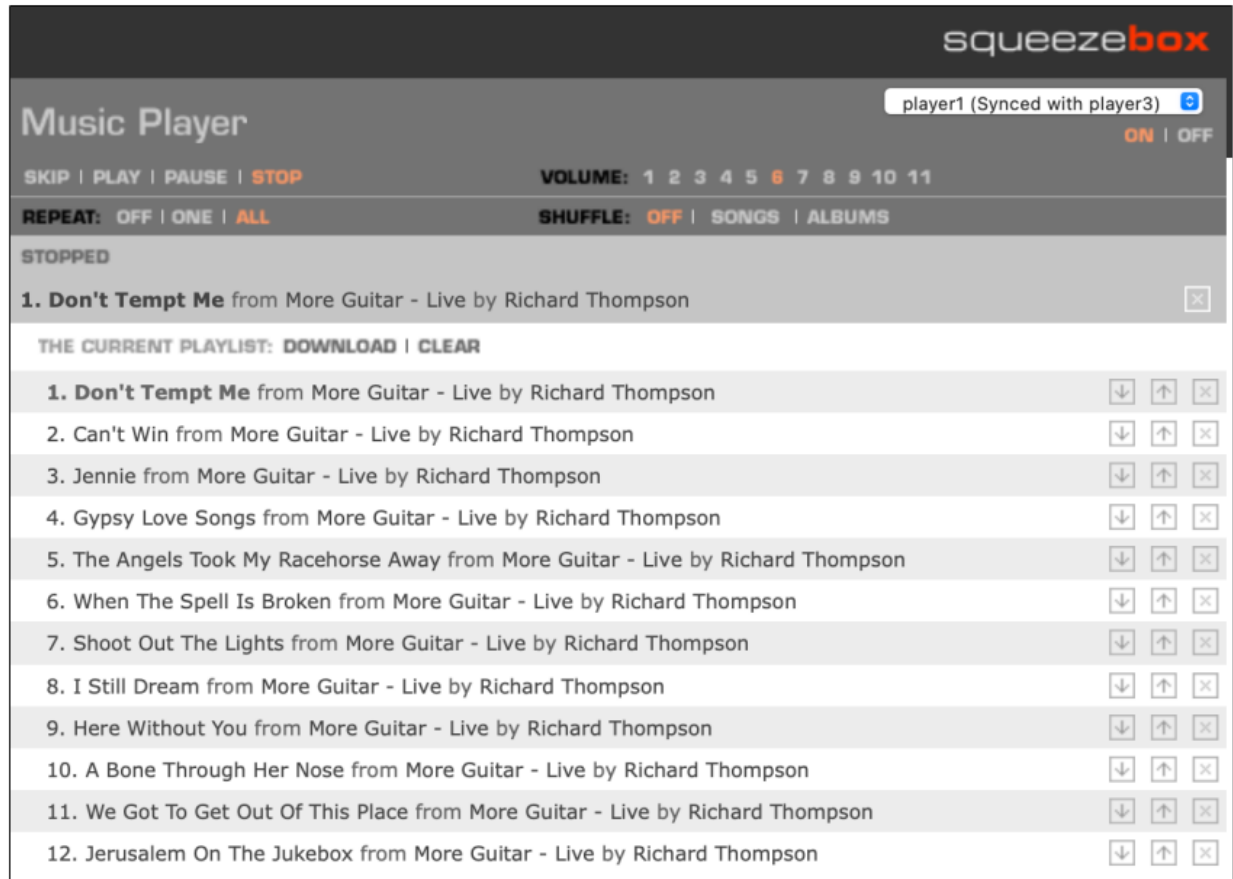
```
tcpdump -i eth0 -s 0 -w slimserver2-02.pcap
```

487. In the Web UI, select player1 and add an album ("More Guitar - Live") to the playlist.



488. The album tracks are added to player1's playlist. Track 1 ("Don't Tempt Me") is the current track. Playback is stopped.

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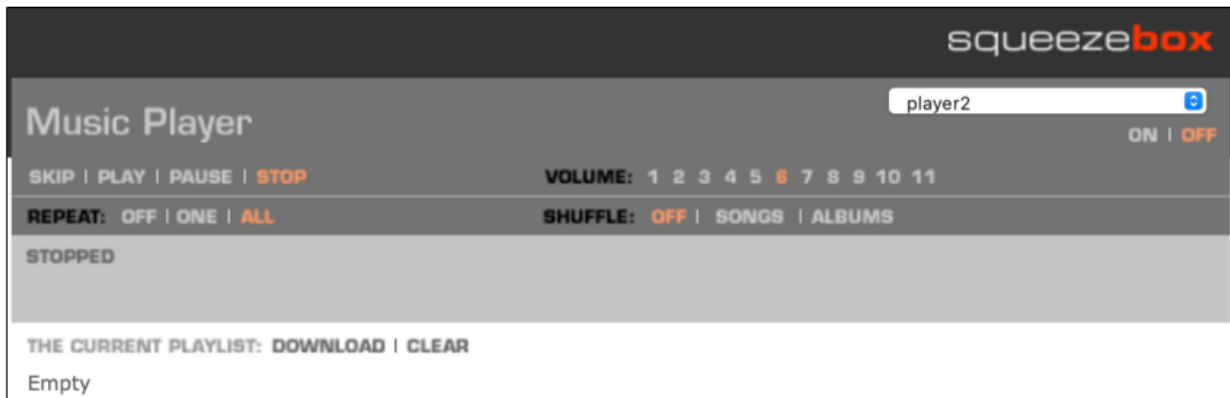


489. player1 shows "Don't Tempt Me" (1 of 12) as the current track. Playback is stopped.

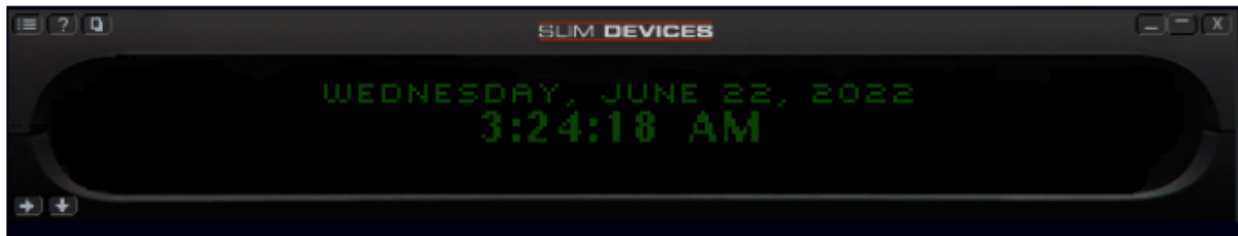


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490. The Web UI shows player2 as stopped, with an empty playlist.

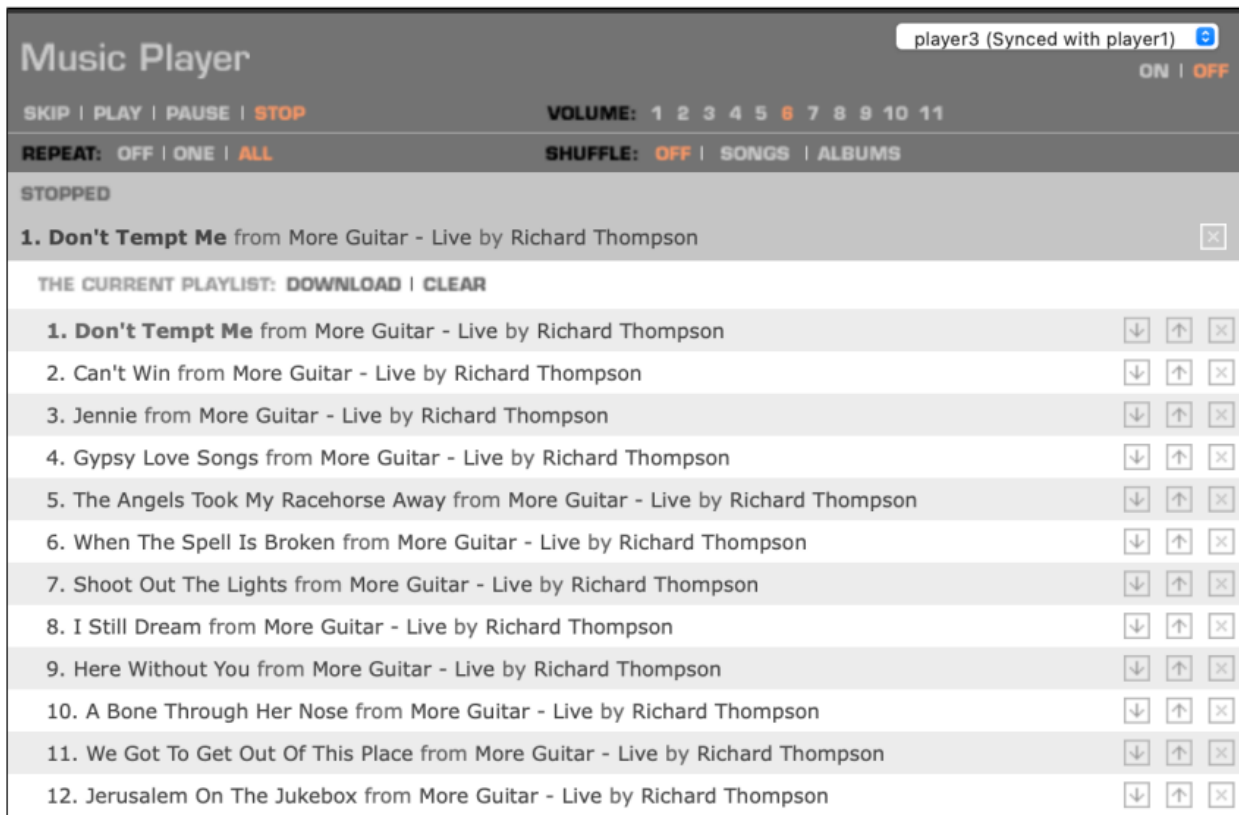


491. player2 is still powered off, in the screensaver.

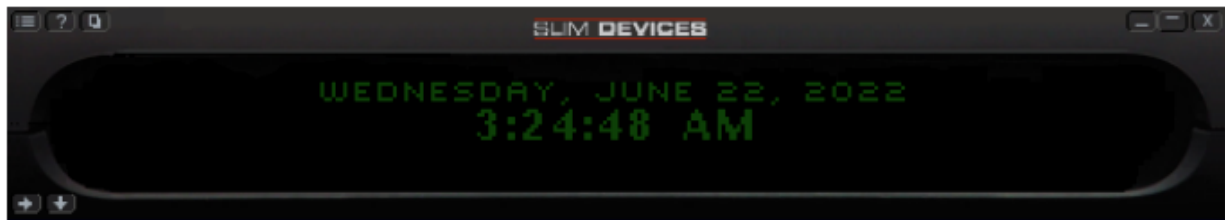


492. The Web UI shows player3 as stopped with the same playlist as player1.

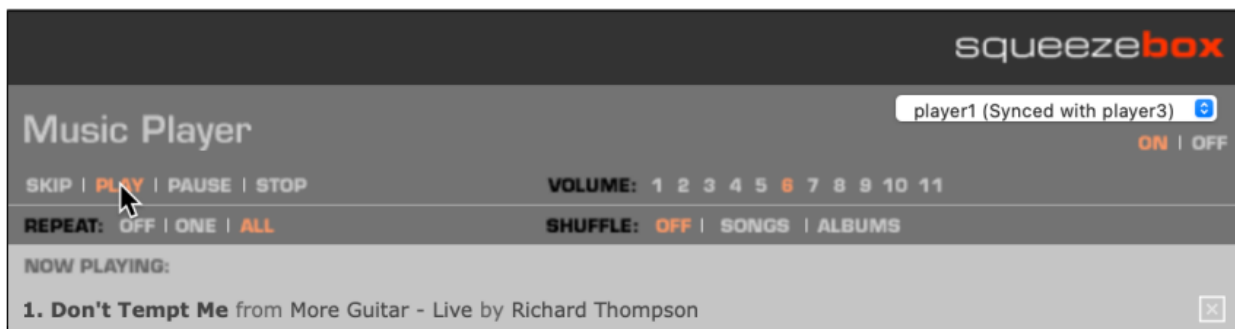
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493. player3 is still powered off, in the screensaver.



494. In the Web UI, Select player1 and press "PLAY."

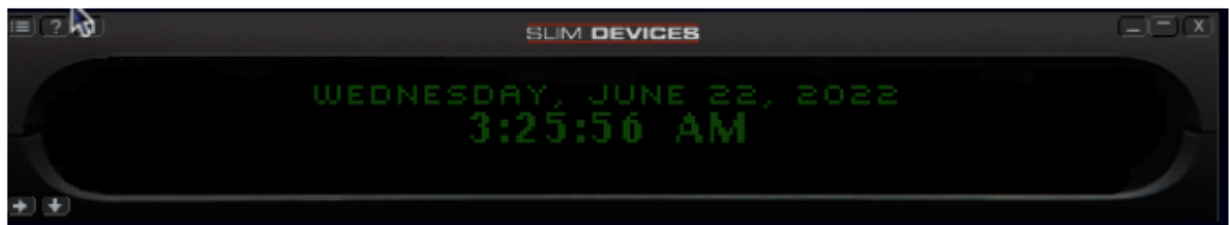


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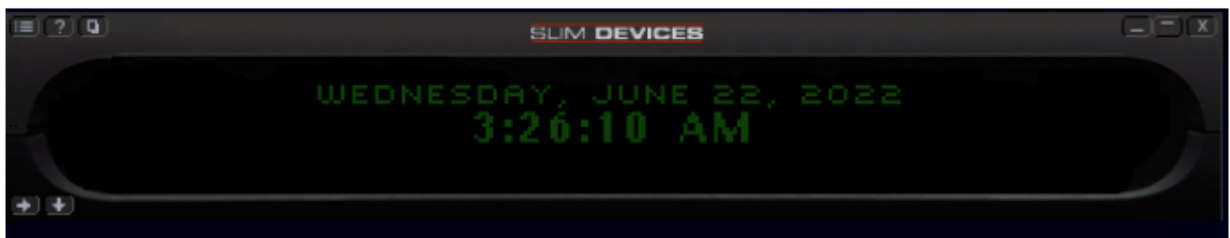
495. player1 plays "Don't Tempt Me" (1 of 12).



496. player2 is still powered off, in the screensaver.

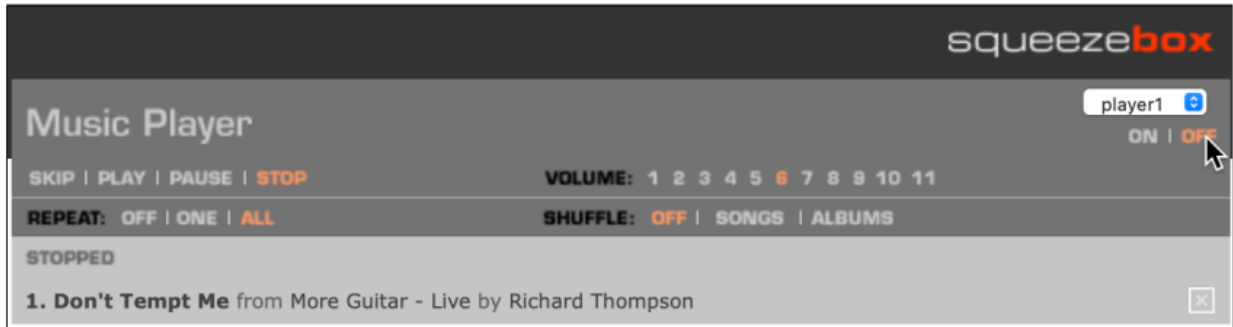


497. player3 is still powered off, in the screensaver.



498. In the Web UI, power off player1.

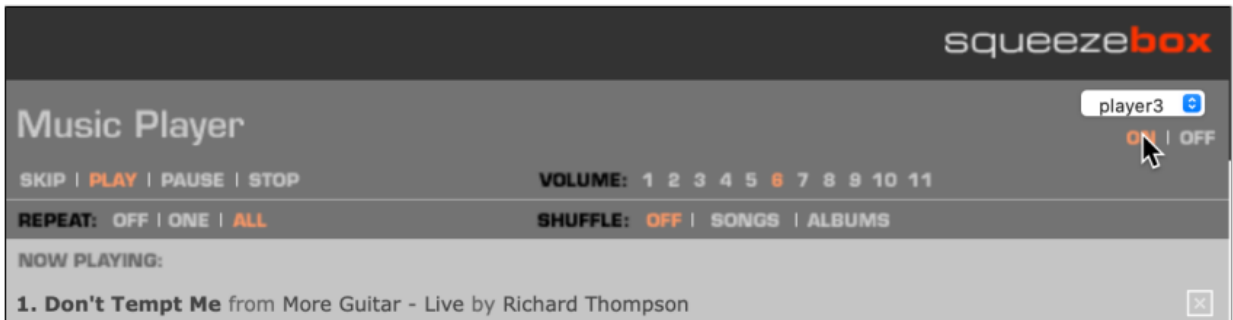
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499. player1 is powered off, in the screensaver.



500. In the Web UI, power on player3.



501. player3 plays "Don't Tempt Me" (1 of 12).

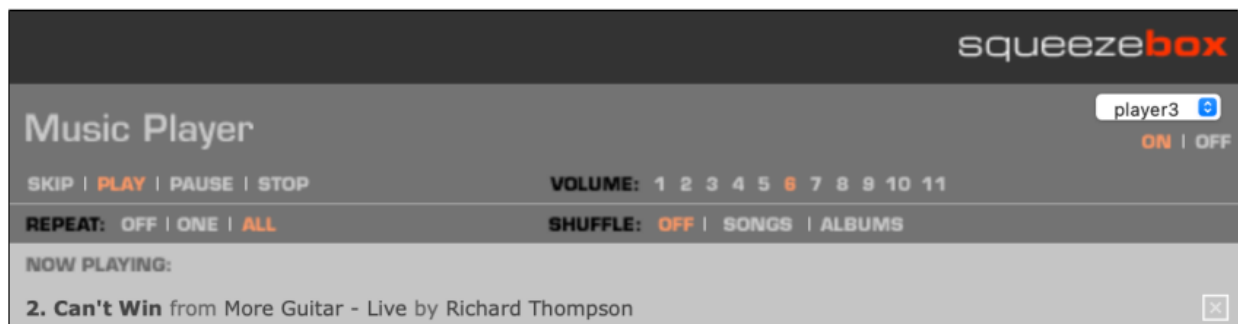
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502. player1 is still powered off, in the screensaver.

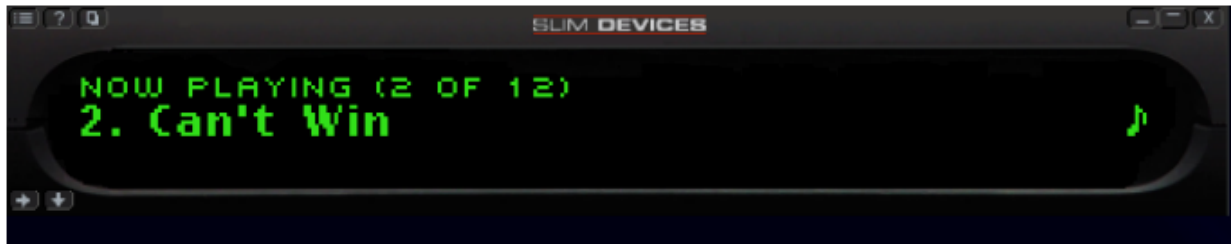


503. Wait until track 1 finishes playing. The Web UI shows player3 as playing track 2 ("Can't Win").



504. player3 plays "Can't Win" (2 of 12).

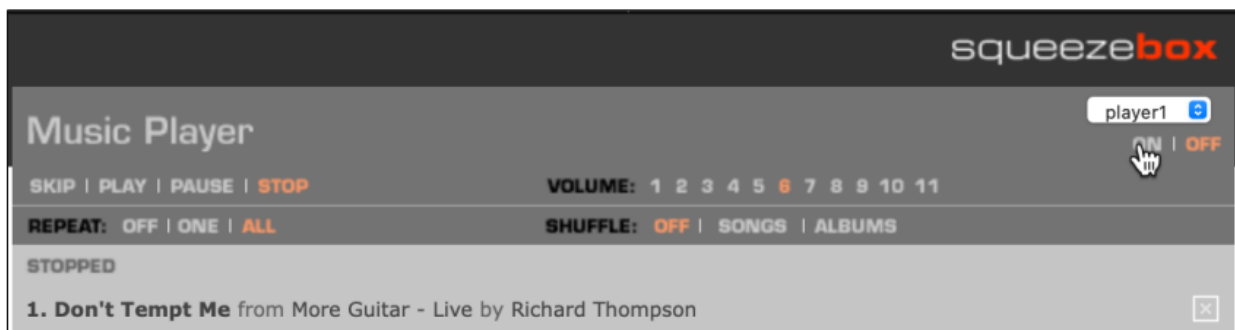
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505. player1 is still powered off, in the screensaver.

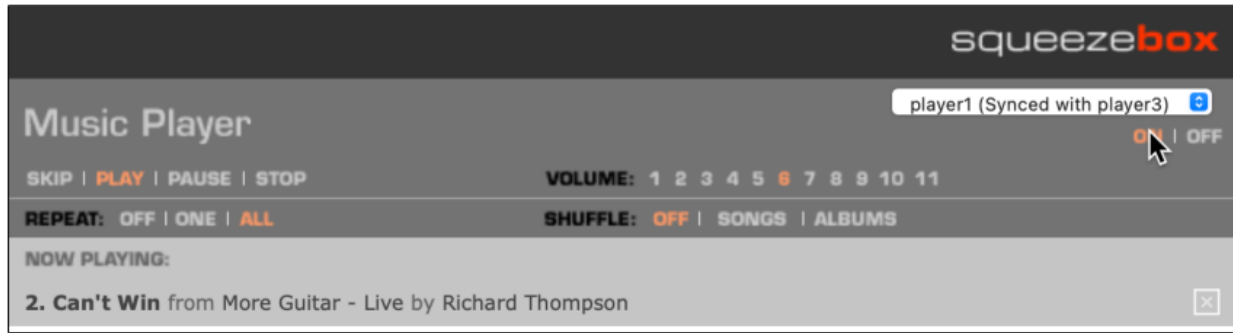


506. The Web UI shows player1 as off, stopped, and with track 1 still as the current track.



507. In the Web UI, power on player1. The Web UI shows player1 as on, playing, and with track 2 as the current track.

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508. player1's screen briefly shows the home screen:

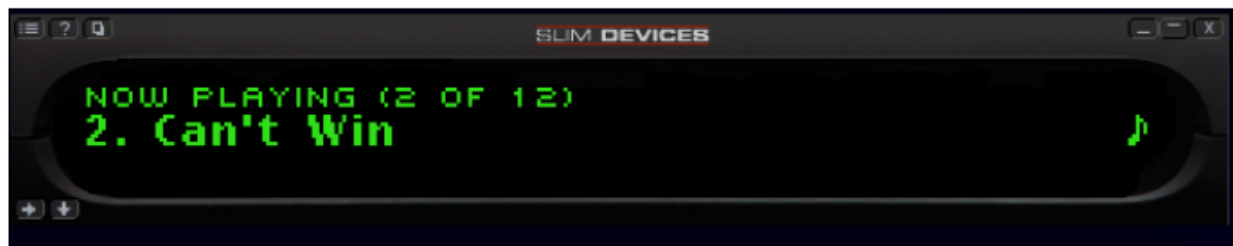


509. before transitioning to playing "Can't Win" (2 of 12).

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510. player3 continues to play "Can't Win" (2 of 12).



511. At this point, in the Web UI, we can stop playback. As shown above, in the situation where (1) player3 is playing and (2) player1 is synchronized with player3 but off, then powering on player1 causes player1 to play along with player3.

512. Analyzing the tcpdump session data using Wireshark shows when each player is powered on. As discussed above regarding powering up a player to operate with a sync group, SlimServer sends a series of SlimProto messages when powering on a player. One of the SlimProto messages is a 'grfb' command, which sets the brightness to the power-on brightness level (as opposed to the dimmed brightness when off). Similarly powering off a player sends a 'grfb' command to set the brightness to the power-off brightness level. A 'grfb' packet carries the

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brightness code as the sole payload. The brightness code has five possible values (0, 1, 4, 16, 30), where 0 is the minimum and 30 is the maximum. Slim::Player::SqueezeboxG::brightness(), Slim/Player/SqueezeboxG.pm (v5.3.1), 80–91 at 88; Slim::Player::SqueezeboxG::maxBrightness(), Slim/Player/SqueezeboxG.pm (v5.3.1), 93–95; @Slim::Player::SqueezeboxG::brightnessMap, Slim/Player/SqueezeboxG.pm (v5.3.1), 78.

513. Identify 'grfb' packets using a WireShark display filter that selects for: source port 3483 — SlimProto from server to player; TCP len > 0 — to filter out pure ACKs; SlimProto command code "grfb".

```
tcp.srcport == 3483 && tcp.len > 0 && data.data[2:4] == "grfb"
```

514. There are three matching packets: packet 10349 — sent to player1 (192.168.136.129); packet 14761 — sent to player3 (192.168.136.131); packet 28545 — sent to player1 (192.168.136.129).

tcp.srcport == 3483 && tcp.len > 0 && data.data[2:4] == "grfb"							
No.	Time	Source	Destination	Protocol	Source Port	Destination Port	Length
10349	03:26:44.616435	192.168.136.135	192.168.136.129	TCP	3483	32886	74
14761	03:28:11.603682	192.168.136.135	192.168.136.131	TCP	3483	32885	74
28545	03:32:36.987532	192.168.136.135	192.168.136.129	TCP	3483	32886	74

515. Packet 10349 has brightness code 0x01 (1), which is very dim and represents dimming the display when powering off player1 (192.168.136.129).

```
> Frame 10349: 74 bytes on wire (592 bits), 74 bytes captured (592 bits)
> Ethernet II, Src: VMware_3b:b5:d2 (00:0c:29:3b:b5:d2), Dst: VMware_45:6f:c2 (00:0c:29:45:6f:c2)
> Internet Protocol Version 4, Src: 192.168.136.135, Dst: 192.168.136.129
> Transmission Control Protocol, Src Port: 3483, Dst Port: 32886, Seq: 164531, Ack: 11135, Len: 8
> Data (8 bytes)
0000  00 0c 29 45 6f c2 00 0c 29 3b b5 d2 08 00 45 00  ..)Eo...);...E.
0010  00 3c 5f 29 40 00 40 06 49 39 c0 a8 88 87 c0 a8  <_)@.@ I9.....
0020  88 81 0d 9b 80 76 91 9c e1 1c 7c 0e 51 fa 80 18  ....v...|.Q...
0030  05 a8 92 88 00 00 01 01 08 0a 03 34 54 71 02 d3  ....4Tq...
0040  84 92 00 06 67 72 66 62 00 01  ..grfb..
```

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516. Packet 14761 has brightness code 0x1e (30), which is maximum brightness and represents brightening the display when powering on player3 (192.168.136.131).

```
> Frame 14761: 74 bytes on wire (592 bits), 74 bytes captured (592 bits)
> Ethernet II, Src: VMware_3b:b5:d2 (00:0c:29:3b:b5:d2), Dst: VMware_b2:5e:60 (00:0c:29:b2:5e:60)
> Internet Protocol Version 4, Src: 192.168.136.135, Dst: 192.168.136.131
> Transmission Control Protocol, Src Port: 3483, Dst Port: 32885, Seq: 214433, Ack: 14441, Len: 8
> Data (8 bytes)
0000  00 0c 29 b2 5e 60 00 0c 29 3b b5 d2 08 00 45 00  ..)^...);...E
0010  00 3c b5 46 40 00 40 06 f3 19 c0 a8 88 87 c0 a8  <@. @. C.....
0020  88 83 0d 9b 80 75 93 59 d6 54 75 1d 5b 58 80 18  ....u.Y.Tu[X..
0030  05 a8 92 8a 00 00 01 01 08 0a 03 35 a8 a3 02 ae  ....5....
0040  28 bb 00 06 67 72 66 62 00 1e  (.grfb ..
```

517. Packet 28545 has brightness code 0x1e (30), which is maximum brightness and represents brightening the display when powering on player1 (192.168.136.129).

```
> Frame 28545: 74 bytes on wire (592 bits), 74 bytes captured (592 bits)
> Ethernet II, Src: VMware_3b:b5:d2 (00:0c:29:3b:b5:d2), Dst: VMware_45:6f:c2 (00:0c:29:45:6f:c2)
> Internet Protocol Version 4, Src: 192.168.136.135, Dst: 192.168.136.129
> Transmission Control Protocol, Src Port: 3483, Dst Port: 32886, Seq: 365611, Ack: 24511, Len: 8
> Data (8 bytes)
0000  00 0c 29 45 6f c2 00 0c 29 3b b5 d2 08 00 45 00  ..)Eo...);...E
0010  00 3c 64 af 40 00 40 06 43 b3 c0 a8 88 87 c0 a8  <d@.@.C.....
0020  88 81 0d 9b 80 76 91 9f f2 94 7c 0e 86 3a 80 18  ....v...|...:
0030  05 a8 92 88 00 00 01 01 08 0a 03 39 b6 38 02 d8  ....9.8..
0040  e6 87 00 06 67 72 66 62 00 1e  ..grfb ..
```

518. The SlimServer source code shows that, when powering on, the player sets the powerOnBrightness (ll. 224-229) and then restores the sync group (ll.230–231).

## Slim/Player/Player.pm (v5.3.1)

```
if ($on) {
    Slim::Buttons::Common::setMode($client, 'home');

    my $welcome = ($client->linesPerScreen() == 1) ? '' : Slim::Display::Display::
center(Slim::Utils::Strings::string('WELCOME_TO_' . $client->model));
    my $welcome2 = ($client->linesPerScreen() == 1) ? '' : Slim::Display::Display::
center(Slim::Utils::Strings::string('FREE_YOUR_MUSIC'));
    $client->showBriefly($welcome, $welcome2);

    # restore the saved brightness, unless its completely dark...
    my $powerOnBrightness = Slim::Utils::Prefs::clientGet($client,
"powerOnBrightness");

    if ($powerOnBrightness < 1) {
        $powerOnBrightness = 1;
    }
    Slim::Utils::Prefs::clientSet($client, "powerOnBrightness", $powerOnBrightness);
    #check if there is a sync group to restore
    Slim::Player::Sync::restoreSync($client);
}
```

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Slim::Player::Player::power(), Slim/Player/Player.pm (v5.3.1), 203–247 at 217–231

519. Setting the brightness results in sending a 'grfb' command.

Slim::Player::Player::power(), Slim/Player/Player.pm (v5.3.1), 203–247 at 229;

Slim::Utils::Prefs::clientSet(), Slim/Utils/Prefs.pm (v5.3.1), 481–489 at 488;

Slim::Utils::Prefs::onChange(), Slim/Utils/Prefs.pm (v5.3.1), 312–327 at 320;

\$prefChange{'CLIENTPREFS'}{'powerOnBrightness'}, Slim/Utils/Prefs.pm (v5.3.1), 194–199 at 197.

**Slim/Player/SqueezeboxG.pm (v5.3.1)**

```
sub brightness {
    my $client = shift;
    my $delta = shift;

    my $brightness = $client->SUPER::brightness($delta, 1);
    if (!defined($brightness)) { $brightness = $client->maxBrightness(); }
    if (defined($delta)) {
        my $brightnesscode = pack('n', $brightnessMap[$brightness]);
        $client->sendFrame('grfb', \"$brightnesscode");
    }
    return $brightness;
}
```

Slim::Player::SqueezeboxG::brightness(), Slim/Player/SqueezeboxG.pm (v5.3.1), 80–91 at 88

Slim::Player::Squeezebox::sendFrame(), Slim/Player/Squeezebox.pm (v5.3.1), 514–533

520. After restoring the power-on brightness level, SlimServer restores the player to its sync group. When the master is in 'play' mode, SlimServer causes the client to jump to the current song in the master's playlist and transition from 'stop' mode to 'play' mode. SlimServer sends a 'strm' SlimProto command to the player to start playing the master's current song.

Slim::Player::Player::power(), Slim/Player/Player.pm (v5.3.1), 203–247 at 230–231

Slim::Player::Sync::restoreSync(), Slim/Player/Sync.pm (v5.3.1), 196–214 at 209

Slim::Player::Sync::sync(), Slim/Player/Sync.pm (v5.3.1), 132–167 at 159

Slim::Control::Command::execute(), Slim/Control/Command.pm (v5.3.1), 24–713 at 543

Slim::Player::Source::jumpto(), Slim/Player/Source.pm (v5.3.1), 604–640 at 614, 639

Slim::Player::Source::playmode(), Slim/Player/Source.pm (v5.3.1), 285–438 at 285–438

Slim::Player::Source::playmode(), Slim/Player/Source.pm (v5.3.1), 285–438 at 326–343, 393

Slim::Player::Squeezebox::play(), Slim/Player/Squeezebox.pm (v5.3.1), 99–107 at 104

Slim::Player::Squeezebox::stream(), Slim/Player/Squeezebox.pm (v5.3.1), 404–512 at 506

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Slim::Player::Squeezebox::sendFrame(), Slim/Player/Squeezebox.pm (v5.3.1), 514–533

**Command: "strm"**

This takes 16 bytes data of the form:

\$command	1 byte	's' start, 'p' pause, 'u' unpause, 'q' stop
\$autostart	1 byte	(buffer threshold to start playing at) '0' off, '1' 25%, '2' 50%, '3' 75%, '4' 100%
\$formatbyte	1 byte	'p' for pcm data, 'm' for mp3
\$pcmsamplesize	1 byte	'0' = 8, '1' = 16, '2' = 20, '3' = 32 usually '1' ('?' for mp3)
\$pcmsamplerate	1 byte	'0'=11kHz, '1'=22kHz, '2'=32kHz, '3'=44.1kHz, '4'=48kHz usually '3' ('?' for mp3)
\$pcmchannels	1 byte	'1'=mono, '2'=stereo usually '2' ('?' for mp3)
\$pcmendian	1 byte	'0' = big, '1' = little ('1' for wav, '0' for aif, '?' for mp3)
\$prebuffer_silence	1 byte	usually 5 (mpeg prebuffer x frames of silence)
\$spdif_enable	1 byte	'0'=auto, '1'=on, '2'=off usually 0
	1 byte	reserved
\$server_port	2 bytes	Server Port to use (9000 is the default)
\$server_ip	4 bytes	0 means use IP of control server

This is followed by an HTTP header itself. This is used to obtain the stream data eg:

```
GET /stream.mp3?player=$client-id HTTP/1.0
(Authorization: Basic $password)
(blank line)
```

The Auth line is only sent if authorization is in use. \$client-id is the usually the MAC address of the player and \$password is a password generated by the server.

[http://<SLIMSERVER\\_ADDR>:9000/html/docs/slimproto.html](http://<SLIMSERVER_ADDR>:9000/html/docs/slimproto.html)  
 HTML/EN/html/docs/slimproto.html

521. Consequently, when player1 powers on and rejoins an already-playing sync group, the SlimServer sends an 'strm' SlimProto message to the player to initiate playback. Isolate on SlimProto packets from SlimServer to player1 are by using a WireShark display filter that selects for: source port 3483 — from SlimServer; TCP payload length > 0 — filter out pure ACKs; destination IP is 192.168.136.129 — to player1 . . .

522. Which is expressed as:

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```
tcp.srcport == 3483 && tcp.len > 0 && ip.dst == 192.168.136.129
```

tcp.srcport == 3483 && tcp.len > 0 && ip.dst == 192.168.136.129							
No.	Time	Source	Destination	Protocol	Source Port	Destination Port	Length
28543	03:32:36.986751	192.168.136.135	192.168.136.129	TCP	3483	32886	634
28545	03:32:36.987532	192.168.136.135	192.168.136.129	TCP	3483	32886	74
28547	03:32:36.990998	192.168.136.135	192.168.136.129	TCP	3483	32886	132
28549	03:32:36.991542	192.168.136.135	192.168.136.129	TCP	3483	32886	148
28551	03:32:36.991937	192.168.136.135	192.168.136.129	TCP	3483	32886	132
28565	03:32:36.994092	192.168.136.135	192.168.136.129	TCP	3483	32886	132

523. As discussed above, slimserver1 sends a 'grfb' message in packet 28545 as part of the power-on sequence for player1 (192.168.136.129). The immediately following packets are: packet 28547 — 'i2cc'; packet 28549 — 'strm'.

```
> Frame 28547: 132 bytes on wire (1056 bits), 132 bytes captured (1056 bits)
> Ethernet II, Src: VMware_3b:b5:d2 (00:0c:29:3b:b5:d2), Dst: VMware_45:6f:c2 (00:0c:29:45:6f:c2)
> Internet Protocol Version 4, Src: 192.168.136.135, Dst: 192.168.136.129
> Transmission Control Protocol, Src Port: 3483, Dst Port: 32886, Seq: 365619, Ack: 24511, Len: 66
> Data (66 bytes)
0000  00 0c 29 45 6f c2 00 0c 29 3b b5 d2 08 00 45 00  ..)Eo... );...E.
0010  00 76 64 b1 40 00 40 06 43 77 c0 a8 88 87 c0 a8  ..vd.@.@. Cw.....
0020  88 81 0d 9b 80 76 91 9f f2 9c 7c 0e 86 3a 80 18  ....v... |...:..
0030  05 a8 92 c2 00 00 01 01 08 0a 03 39 b6 3b 02 d8  ....9...<...
0040  e6 88 00 40 69 32 63 63 73 3e 77 68 77 e0 77 00  ..@i2cc s>whw.w.
0050  77 00 77 01 77 03 77 54 77 00 77 02 77 00 70 00  w.w.w.wT w.w.w.w.p.
0060  73 3e 77 68 77 e0 77 00 77 00 77 01 77 03 77 57  s>whw.w. w.w.w.wW
0070  77 00 77 02 77 00 70 00 73 3e 77 6c 77 00 77 10  w.w.w.p. s>wlw.w.
0080  77 76 70 00  wvp.
```

```
> Frame 28549: 148 bytes on wire (1184 bits), 148 bytes captured (1184 bits)
> Ethernet II, Src: VMware_3b:b5:d2 (00:0c:29:3b:b5:d2), Dst: VMware_45:6f:c2 (00:0c:29:45:6f:c2)
> Internet Protocol Version 4, Src: 192.168.136.135, Dst: 192.168.136.129
> Transmission Control Protocol, Src Port: 3483, Dst Port: 32886, Seq: 365685, Ack: 24511, Len: 82
> Data (82 bytes)
0000  00 0c 29 45 6f c2 00 0c 29 3b b5 d2 08 00 45 00  ..)Eo... );...E.
0010  00 86 64 b3 40 00 40 06 43 65 c0 a8 88 87 c0 a8  ..d.@.@. Ce.....
0020  88 81 0d 9b 80 76 91 9f f2 de 7c 0e 86 3a 80 18  ....v... |...:..
0030  05 a8 92 d2 00 00 01 01 08 0a 03 39 b6 3c 02 d8  ....9...<...
0040  e6 8b 00 50 73 74 72 6d 73 30 6d 3f 3f 3f 3f 00  ..Pstrm s0m?????
0050  00 00 00 00 0d 9c 00 00 00 00 23 28 00 00 00 00  .....#(....
0060  47 45 54 20 2f 73 74 72 65 61 6d 2e 6d 70 33 3f  GET /str eam.mp3?
0070  70 6c 61 79 65 72 3d 64 62 3a 33 61 3a 35 32 3a  player=d b:3a:52:
0080  65 36 3a 37 30 3a 36 62 20 48 54 54 50 2f 31 2e  e6:70:6b HTTP/1.
0090  30 0a 0a 0a  0...
```

524. Consequently, packet 28549 represents the 'strm' message sent to player1 to initiate playback as part of restoring player1 to its sync group.

525. A network trace illustrates the synchronization confirmation message. A tcpdump

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session was initiated on the SlimServer host before using the directional buttons on the SoftSqueeze player1 remote to navigate to the "Synchronize" menu and then to select synchronization with player2 and player3. The session was terminated after the player transitioned from the pre-sync screen.



526. to the post-sync screen:



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527. We first identify the IR SlimProto packets, which send IR codes from the player to the SlimServer. The player sends an IR remote code using the SlimProto IR packet to the SlimServer for processing. An IR packet is a client-to-server message, which consists of:

Operation ("IR ") — offset 0, four bytes  
 Data Packet Length — offset 4, four bytes  
 Time — offset 8, four bytes  
 Format — offset 12, one byte  
 NoBits — offset 13, one byte  
 IRCode — offset 14, four bytes

#### Client -> Server Communications

A command to the server consists of three parts:

1. The 1st 4 bytes specify the operation. The following operations are supported:
  - HELO
  - IR (note the two spaces after IR)
  - RESP
  - STAT
  - BYE!
2. The 2nd part (of four bytes) is simply the length of the data packet (in Network order).
3. The 3rd part is the data itself.

**"IR "** (Note the two spaces to make it up to 4 characters.)

One of these packets is recieved for each IR code recieved by the player.

**Data Length:** Fixed at 10 bytes.

**Format:**

Time	4 bytes	Time since player startup in ticks (@1Khz)
Format	1 byte	Code Format (ignored by the server for now - Code represents type of IR code - NEC, JVC or Sony)
NoBits	1 byte	Length of IR Code (ignored by the server for now - 16 bits for JVC, 32 bits for NEC?)
IRCode	4 bytes	the IR Code itself (upto 32 bits)

[http://<SLIMSERVER\\_ADDR>:9000/html/docs/slimproto.html](http://<SLIMSERVER_ADDR>:9000/html/docs/slimproto.html)  
 HTML/EN/html/docs/slimproto.html

528. The "arrow\_right" IR code is 7689d02f.

arrow\_right, IR/Slim\_Devices\_Remote.ir (v5.3.1), 21

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529. The IR SlimProto packets are then identified using a WireShark display filter that selects for:

destination port 3483 — from player to SlimServer  
 data that begins with "IR " — the IR type  
 data that has 0x7689d02f in the four bytes beginning at offset 14

530. which is expressed as:

```
tcp.dstport == 3483 && data.data[0:4] == "IR " && data.data[14:4] == 76:89:d0:2f
```

531. There are six matching packets. The last packet (#277) represents the "arrow\_right" IR code that initiates the sync.

tcp.dstport == 3483 && data.data[0:4] == "IR " && data.data[14:4] == 76:89:d0:2f					
No.	Time	Source	Protocol	Info	
72	5.613	192.168.136.129	TCP	32824 → 3483 [PSH, ACK]	Seq=229 Ack=2841 Win=4300 Len=18 TSval=4772482 TSecr=4895027
86	5.705	192.168.136.129	TCP	32824 → 3483 [PSH, ACK]	Seq=247 Ack=5113 Win=4300 Len=18 TSval=4772574 TSecr=4895697
144	9.145	192.168.136.129	TCP	32824 → 3483 [PSH, ACK]	Seq=453 Ack=10793 Win=4300 Len=18 TSval=4776014 TSecr=4899035
154	9.246	192.168.136.129	TCP	32824 → 3483 [PSH, ACK]	Seq=471 Ack=13065 Win=4300 Len=18 TSval=4776115 TSecr=4899243
267	17.666	192.168.136.129	TCP	32824 → 3483 [PSH, ACK]	Seq=793 Ack=20449 Win=4300 Len=18 TSval=4784534 TSecr=4907677
277	17.758	192.168.136.129	TCP	32824 → 3483 [PSH, ACK]	Seq=811 Ack=22721 Win=4300 Len=18 TSval=4784626 TSecr=4907764

532. After packet 277, SlimServer responds with a series of 'grfd' command packets to the player. Each such packet begins with a two-byte length field and a four-byte command field. The server-to-player commands are identified using a WireShark display filter that selects for:

source port 3483 — from SlimServer to player  
 TCP length > 0 — to filter out pure acknowledgement packets  
 command code 'grfd'

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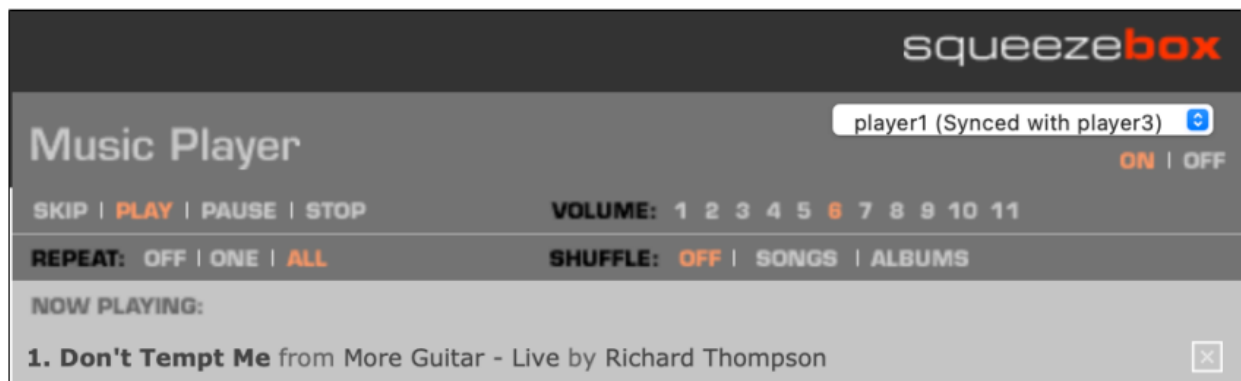
```
tcp.srcport == 3483 && tcp.len > 0 && data.data[2:4] == "grfd"
```

No.	Time	Source	Protocol	Info
275	17.774	192.168.136.128	TCP	3483 → 32824 [PSH, ACK] Seq=22133 Ack=829 Win=1448 Len=568 TSval=4907704 TSecr=4784330
278	17.774	192.168.136.128	TCP	3483 → 32824 [PSH, ACK] Seq=22721 Ack=829 Win=1448 Len=568 TSval=4907790 TSecr=4784626
280	17.815	192.168.136.128	TCP	3483 → 32824 [PSH, ACK] Seq=23289 Ack=829 Win=1448 Len=568 TSval=4907831 TSecr=4784683
282	17.826	192.168.136.128	TCP	3483 → 32824 [PSH, ACK] Seq=23857 Ack=829 Win=1448 Len=568 TSval=4907842 TSecr=4784683
284	17.852	192.168.136.128	TCP	3483 → 32824 [PSH, ACK] Seq=24425 Ack=829 Win=1448 Len=568 TSval=4907868 TSecr=4784694
292	18.653	192.168.136.128	TCP	3483 → 32814 [PSH, ACK] Seq=10225 Ack=723 Win=1448 Len=568 TSval=4908669 TSecr=3124568
294	18.657	192.168.136.128	TCP	3483 → 32813 [PSH, ACK] Seq=10225 Ack=723 Win=1448 Len=568 TSval=4908673 TSecr=3322027
296	18.661	192.168.136.128	TCP	3483 → 32824 [PSH, ACK] Seq=24993 Ack=867 Win=1448 Len=568 TSval=4908677 TSecr=4784905
304	19.653	192.168.136.128	TCP	3483 → 32814 [PSH, ACK] Seq=10793 Ack=761 Win=1448 Len=568 TSval=4909669 TSecr=3125570
306	19.657	192.168.136.128	TCP	3483 → 32813 [PSH, ACK] Seq=10793 Ack=761 Win=1448 Len=568 TSval=4909673 TSecr=3323029
308	19.661	192.168.136.128	TCP	3483 → 32824 [PSH, ACK] Seq=25561 Ack=905 Win=1448 Len=568 TSval=4909677 TSecr=4785907
316	20.654	192.168.136.128	TCP	3483 → 32814 [PSH, ACK] Seq=11361 Ack=799 Win=1448 Len=568 TSval=4910670 TSecr=3126572
318	20.658	192.168.136.128	TCP	3483 → 32813 [PSH, ACK] Seq=11361 Ack=799 Win=1448 Len=568 TSval=4910674 TSecr=3324031
320	20.662	192.168.136.128	TCP	3483 → 32824 [PSH, ACK] Seq=26129 Ack=943 Win=1448 Len=568 TSval=4910677 TSecr=4786909
328	21.654	192.168.136.128	TCP	3483 → 32814 [PSH, ACK] Seq=11929 Ack=837 Win=1448 Len=568 TSval=4911670 TSecr=3127574
330	21.658	192.168.136.128	TCP	3483 → 32813 [PSH, ACK] Seq=11929 Ack=837 Win=1448 Len=568 TSval=4911674 TSecr=3325033
332	21.662	192.168.136.128	TCP	3483 → 32824 [PSH, ACK] Seq=26697 Ack=981 Win=1448 Len=568 TSval=4911678 TSecr=4787911

533. The network trace is also revealing for the power on sequence for a player in a sync group. For example, we begin with player1, player2, and player3 all in the same sync group, as shown by the preferences file.

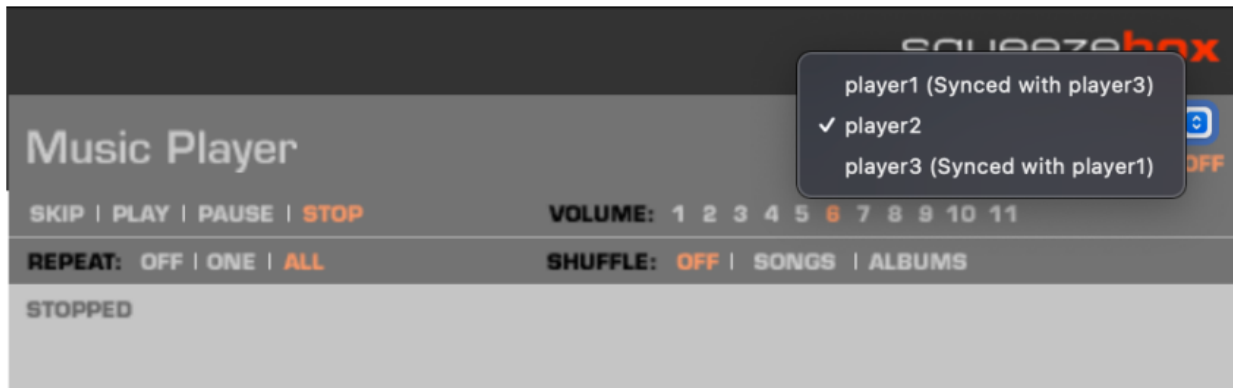
```
[vmuser@slimserver conf]$ grep -P 'playername|syncgroupid' slimserver.conf
0f:59:51:64:dc:d7-playername = player2
0f:59:51:64:dc:d7-syncgroupid = 482986368
51:93:a5:ad:53:20-playername = player3
51:93:a5:ad:53:20-syncgroupid = 482986368
bc:39:f3:c4:1e:29-playername = player1
bc:39:f3:c4:1e:29-syncgroupid = 482986368
```

534. Leave player1 and player3 powered on. Power off player2. Play music in the sync group. player1 and player3 are actively playing music from the sync group's playlist, as shown in the Web UI.

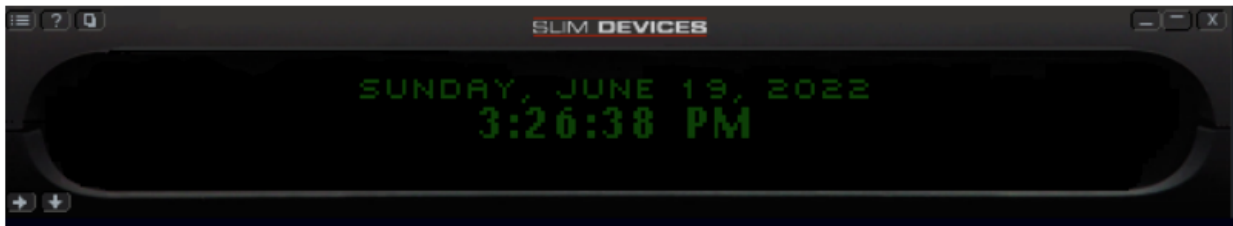


535. player2 is unsynced, stopped, and not playing any playlist.

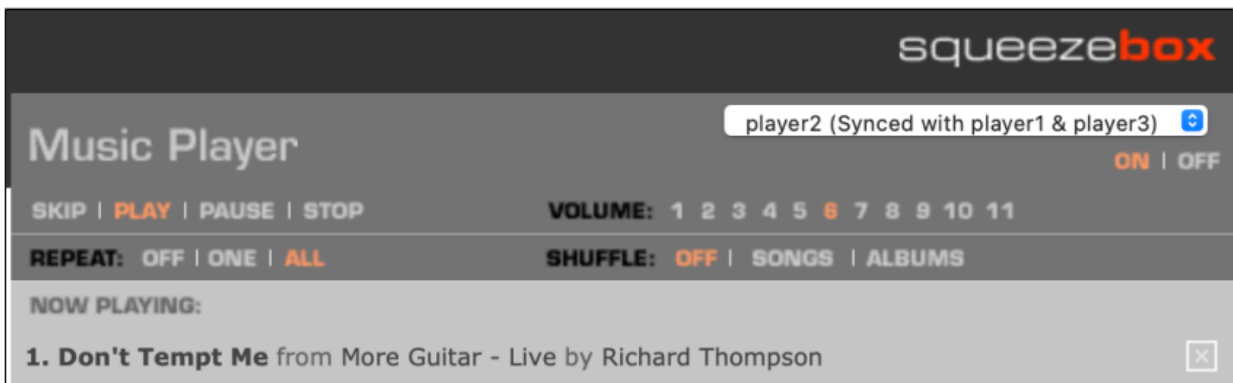
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536. player2's screen shows a dimmed screensaver with the date and time.

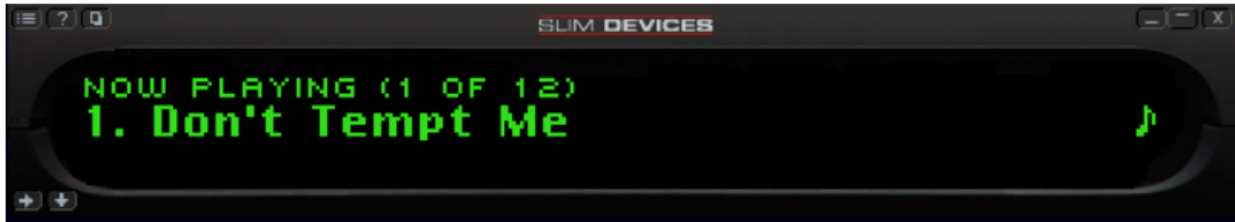


537. player2 synchronizes to player1 and player3, including starting playback of the same song.



538. player2's screen updates to eventually show a Now Playing screen, playing the current song in the sync group's playlist.

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539. And the corresponding network trace follows. A tcpdump session was initiated on the SlimServer host before pressing the "ON" button for player2 in the Web UI. The tcpdump session was terminated after player2 finishes powering up, rejoins the sync group, and begins playing. Analyzing the tcpdump session data using Wireshark shows the power-on network traffic from SlimServer (192.168.136.128) to player2 (192.168.136.130), including idle screen updates ('grfd') every second and a poweron sequence beginning at packet 65 (time 4.948) and ending at packet 130 (time 5.004). The SlimProto packets from SlimServer to player2 are then identified using a WireShark display filter that selects for:

source port 3483 — from SlimServer  
 TCP payload length > 0 — filter out pure ACKs  
 destination IP is 192.168.136.130 — to player2

540. which is expressed as:

```
tcp.srcport == 3483 && tcp.len > 0 && ip.dst == 192.168.136.130
```

No.	Time	Source	Destination	Protocol	Info
1	0.000	192.168.136.128	192.168.136.130	TCP	3483 → 33001 [PSH, ACK] Seq=1 Ack=1 Win=1448 Len=568 TSval=56391237 TSecr=54492416
13	1.000	192.168.136.128	192.168.136.130	TCP	3483 → 33001 [PSH, ACK] Seq=569 Ack=39 Win=1448 Len=568 TSval=56392238 TSecr=54493418
25	2.001	192.168.136.128	192.168.136.130	TCP	3483 → 33001 [PSH, ACK] Seq=1137 Ack=77 Win=1448 Len=568 TSval=56393239 TSecr=54494420
37	3.001	192.168.136.128	192.168.136.130	TCP	3483 → 33001 [PSH, ACK] Seq=1705 Ack=115 Win=1448 Len=568 TSval=56394240 TSecr=54495422
52	4.002	192.168.136.128	192.168.136.130	TCP	3483 → 33001 [PSH, ACK] Seq=2273 Ack=153 Win=1448 Len=568 TSval=56395241 TSecr=54496424
65	4.948	192.168.136.128	192.168.136.130	TCP	3483 → 33001 [PSH, ACK] Seq=2841 Ack=191 Win=1448 Len=568 TSval=56396187 TSecr=54497426
67	4.949	192.168.136.128	192.168.136.130	TCP	3483 → 33001 [PSH, ACK] Seq=3409 Ack=191 Win=1448 Len=8 TSval=56396188 TSecr=54497475
69	4.956	192.168.136.128	192.168.136.130	TCP	3483 → 33001 [PSH, ACK] Seq=3417 Ack=191 Win=1448 Len=66 TSval=56396196 TSecr=54497475
71	4.957	192.168.136.128	192.168.136.130	TCP	3483 → 33001 [PSH, ACK] Seq=3483 Ack=191 Win=1448 Len=82 TSval=56396196 TSecr=54497483
73	4.957	192.168.136.128	192.168.136.130	TCP	3483 → 33001 [PSH, ACK] Seq=3565 Ack=191 Win=1448 Len=66 TSval=56396196 TSecr=54497483
102	4.964	192.168.136.128	192.168.136.130	TCP	3483 → 33001 [PSH, ACK] Seq=3631 Ack=191 Win=1448 Len=66 TSval=56396203 TSecr=54497484
130	5.004	192.168.136.128	192.168.136.130	TCP	3483 → 33001 [PSH, ACK] Seq=3697 Ack=191 Win=1448 Len=568 TSval=56396243 TSecr=54497490
994	6.003	192.168.136.128	192.168.136.130	TCP	3483 → 33001 [PSH, ACK] Seq=4265 Ack=305 Win=1448 Len=568 TSval=56397242 TSecr=54497597

541. Packets 1, 13, 25, 37, and 52 contain 'grfd' SlimProto messages with very similar

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data, consistent with minor time updates in the screensaver screen. For example, packet 1 (time 0.000) contains the following data:

```
> Frame 1: 634 bytes on wire (5072 bits), 634 bytes captured (5072 bits)
> Ethernet II, Src: VMware_a3:52:c6 (00:0c:29:a3:52:c6), Dst: VMware_83:57:01 (00:0c:29:83:57:01)
> Internet Protocol Version 4, Src: 192.168.136.128, Dst: 192.168.136.130
> Transmission Control Protocol, Src Port: 3483, Dst Port: 33001, Seq: 1, Ack: 1, Len: 568
> Data (568 bytes)

0000  00 0c 29 83 57 01 00 0c 29 a3 52 c6 08 00 45 00  ..)·W...·)·R...E·
0010  02 6c d7 ba 40 00 40 06 ce 7d c0 a8 88 80 c0 a8  ·l·@·@··}·.....
0020  88 82 0d 9b 80 e9 31 74 ee 21 2b 20 d2 25 80 18  ....1t·!+·%·
0030  05 a8 94 b2 00 00 01 01 08 0a 03 5c 76 45 03 3f  ....\vE·?
0040  7d 00 02 36 67 72 66 64 02 30 00 00 00 00 00 00  }·6grfd·0·.....
0050  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  .....
0060  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  .....
0070  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  .....
0080  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  .....
0090  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  .....
00a0  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  .....
00b0  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  .....
00c0  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  .....
00d0  00 00 00 00 00 00 00 00 00 00 00 00 48 00 a8 00  .....·H·
00e0  a8 00 a8 00 90 00 00 00 00 00 f0 00 08 00 08 00  .....
00f0  08 00 f0 00 00 00 00 00 00 f8 00 40 00 20 00 10 00  .....·@·
0100  f8 00 00 00 00 00 00 f8 00 88 00 88 00 88 00 70 00  .....p·
0110  00 00 00 00 78 00 a0 00 a0 00 a0 84 79 82 01 22  ....x·...·y·"
0120  01 fe 80 dc 40 00 38 00 40 00 80 66 00 66 00 00  ....@·8· @·f·f·
0130  04 00 08 86 01 8e 01 1a 01 f2 00 e2 00 00 00 00  .....
0140  00 00 10 dc 09 fe 09 22 09 fe f0 dc 00 00 00 00  ...."
0150  f0 00 08 66 08 66 08 00 f0 00 00 fc 01 fe f9 02  ....f·f·
0160  41 fe 20 fc 10 00 f8 00 00 00 00 86 f9 8e a9 1a  A·
0170  a9 f2 88 e2 00 00 00 00 00 00 00 00 00 00 00 00  .....
0180  00 00 00 00 40 00 f9 fe 01 fe 01 10 01 f0 00 e0  ....@·
0190  40 00 a8 00 a9 fe a9 e0 70 78 00 1e 00 0e 04 18  @·...px·
01a0  08 60 01 fe 01 fe 00 00 00 00 00 00 00 00 00 00  ·
01b0  98 00 a8 00 a8 00 a8 00 48 00 00 00 00 00 70 00  .....H·p·
01c0  88 00 88 00 88 00 70 00 00 00 00 98 00 a8 00  ....p·
01d0  a8 00 a8 00 48 00 00 00 00 00 98 00 a8 00 a8 00  ....H·
01e0  a8 00 48 00 00 00 00 00 00 00 00 00 00 00 00 00  ·H·
01f0  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  .....
0200  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  .....
0210  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  .....
0220  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  .....
0230  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  .....
0240  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  .....
0250  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  .....
```

542. Packet 52 (time 4.002) contains similar data to packet 1:

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```

> Frame 52: 634 bytes on wire (5072 bits), 634 bytes captured (5072 bits)
> Ethernet II, Src: VMware_a3:52:c6 (00:0c:29:a3:52:c6), Dst: VMware_83:57:01 (00:0c:29:83:57:01)
> Internet Protocol Version 4, Src: 192.168.136.128, Dst: 192.168.136.130
> Transmission Control Protocol, Src Port: 3483, Dst Port: 33001, Seq: 2273, Ack: 153, Len: 568
> Data (568 bytes)

0000 00 0c 29 83 57 01 00 0c 29 a3 52 c6 08 00 45 00 ..).W...).R...E.
0010 02 6c d7 ca 40 00 40 06 ce 6d c0 a8 88 80 c0 a8 .l...@.@...m.....
0020 88 82 0d 9b 80 e9 31 74 f7 01 2b 20 d2 bd 80 18 .....1t...+....
0030 05 a8 94 b2 00 00 01 01 08 0a 03 5c 85 e9 03 3f .....\\...?
0040 8c a8 02 36 67 72 66 64 02 30 00 00 00 00 00 00 ..6grfd..0.....
0050 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
0060 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
0070 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
0080 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
0090 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
00a0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
00b0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
00c0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
00d0 00 00 00 00 00 00 00 00 00 00 00 00 48 00 a8 00 .....H...
00e0 a8 00 a8 00 90 00 00 00 00 00 f0 00 08 00 08 00 .....
00f0 08 00 f0 00 00 00 00 00 f8 00 40 00 20 00 10 00 .....@...
0100 f8 00 00 00 00 00 00 f8 00 88 00 88 00 88 00 70 00 .....p...
0110 00 00 00 00 78 00 a0 00 a0 00 a0 84 79 82 01 22 ....x...y..."
0120 01 fe 80 dc 40 00 38 00 40 00 80 66 00 66 00 00 .....@.8...f.f...
0130 04 00 08 86 01 8e 01 1a 01 f2 00 e2 00 00 00 00 ..... " .....
0140 00 00 10 dc 09 fe 09 22 09 fe f0 dc 00 00 00 00 .....f.f...
0150 f0 00 08 66 08 66 08 00 f0 00 00 fc 01 fe f9 02 ...f.f...
0160 41 fe 20 fc 10 00 f8 00 00 00 00 7c f8 fe a9 42 A...|...B
0170 a9 7e 88 3c 00 00 00 00 00 00 00 00 00 00 00 00 ...<...
0180 00 00 00 00 40 00 f9 fe 01 fe 01 10 01 f0 00 e0 ...@...
0190 40 00 a8 00 a9 fe a9 e0 70 78 00 1e 00 0e 04 18 @.....px.....
01a0 08 60 01 fe 01 fe 00 00 00 00 00 00 00 00 00 00 ...`.....
01b0 98 00 a8 00 a8 00 a8 00 48 00 00 00 00 00 70 00 .....H...p...
01c0 88 00 88 00 88 00 70 00 00 00 00 00 98 00 a8 00 .....p...
01d0 a8 00 a8 00 48 00 00 00 00 00 98 00 a8 00 a8 00 ...H...
01e0 a8 00 48 00 00 00 00 00 00 00 00 00 00 00 00 00 ...H...
01f0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
0200 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
0210 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
0220 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
0230 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
0240 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
0250 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....

```

543. Packet 65 contains a 'grfd' SlimProto message with markedly different contents, which is consistent with the Welcome screen that is shown briefly on power on.

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```

> Frame 65: 634 bytes on wire (5072 bits), 634 bytes captured (5072 bits)
> Ethernet II, Src: VMware_a3:52:c6 (00:0c:29:a3:52:c6), Dst: VMware_83:57:01 (00:0c:29:83:57:01)
> Internet Protocol Version 4, Src: 192.168.136.128, Dst: 192.168.136.130
> Transmission Control Protocol, Src Port: 3483, Dst Port: 33001, Seq: 2841, Ack: 191, Len: 568
> Data (568 bytes)

0000  00 0c 29 83 57 01 00 0c 29 a3 52 c6 08 00 45 00  ..)·W···)·R···E·
0010  02 6c d7 ce 40 00 40 06 ce 69 c0 a8 88 80 c0 a8  ·l·@·@·i·····
0020  88 82 0d 9b 80 e9 31 74 f9 39 2b 20 d2 e3 80 18  ·····1t·9+····
0030  05 a8 94 b2 00 00 01 01 08 0a 03 5c 89 9b 03 3f  ······\···?
0040  90 92 02 36 67 72 66 64 02 30 00 00 00 00 00 00  ···6grfd·0····
0050  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ······
0060  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ······
0070  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ······
0080  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ······
0090  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ······
00a0  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ······
00b0  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ······
00c0  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ······
00d0  f0 00 08 00 08 00 f0 00 08 00 08 00 f0 00 00 00  ······
00e0  00 00 f8 00 a8 00 a8 00 88 00 00 00 00 00 f8 00  ······
00f0  08 00 08 00 09 fe 01 fe 01 20 71 20 89 00 88 00  ······q····
0100  88 00 50 7e 00 7e 00 20 70 60 88 60 88 00 88 00  ··P~·~·p`····
0110  70 3c 00 7e 00 52 f8 52 40 72 20 32 40 00 f8 00  p<~·R·R·@r 2@···
0120  00 3c 00 7e f8 52 a8 52 a8 72 88 32 00 00 00 00  ·<~·R·R·r·2···
0130  00 00 00 00 00 00 00 00 00 00 80 00 80 60 f8 78  ······x····
0140  80 3f 80 0c 00 30 00 40 70 00 88 00 88 3c 88 7e  ·?···0·@p····<~
0150  70 42 00 42 00 7e 00 3c 00 00 00 00 00 7c 00 7e  pB·B·~<····|~
0160  48 02 a8 04 a8 7e a8 7e 90 00 00 00 00 7e 70 7e  H····~··~··~p~
0170  88 20 88 60 88 60 70 00 00 00 00 00 f8 00 a0 00  ····p····
0180  a0 00 80 00 00 00 00 7e 80 7e 80 20 f8 40 80 7e  ·····~··~·@~
0190  80 3e 00 20 00 40 48 7e a8 3e a8 00 a8 00 90 7c  ·>··@H~·>····|
01a0  00 7e 00 02 70 04 88 7e a8 7e 98 00 78 00 00 32  ·~·p~·~·x~2···
01b0  00 7a f0 5e 08 4c 08 00 08 00 f1 7e 01 7e 00 00  ·z·^·L····~···
01c0  f8 00 a8 3c a8 7e 88 42 00 42 00 42 f8 00 a8 00  ·<~·B·B·B····
01d0  a8 00 88 00 00 00 00 00 88 00 98 00 a8 00 c8 00  ······
01e0  88 00 00 00 00 00 f8 00 a8 00 a8 00 88 00 00 00  ······
01f0  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ······
0200  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ······
0210  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ······
0220  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ······
0230  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ······
0240  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ······
0250  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ······

```

544. Packet 67 contains a 'grfb' SlimProto message, which is consistent with the message sent to restore the power-on brightness level.

```

> Frame 67: 74 bytes on wire (592 bits), 74 bytes captured (592 bits)
> Ethernet II, Src: VMware_a3:52:c6 (00:0c:29:a3:52:c6), Dst: VMware_83:57:01 (00:0c:29:83:57:01)
> Internet Protocol Version 4, Src: 192.168.136.128, Dst: 192.168.136.130
> Transmission Control Protocol, Src Port: 3483, Dst Port: 33001, Seq: 3409, Ack: 191, Len: 8
> Data (8 bytes)

0000  00 0c 29 83 57 01 00 0c 29 a3 52 c6 08 00 45 00  ..)·W···)·R···E·
0010  00 3c d7 d0 40 00 40 06 d0 97 c0 a8 88 80 c0 a8  ·<~@·@·i·····
0020  88 82 0d 9b 80 e9 31 74 fb 71 2b 20 d2 e3 80 18  ·····1t·q+····
0030  05 a8 92 82 00 00 01 01 08 0a 03 5c 89 9c 03 3f  ······\···?
0040  90 c3 00 06 67 72 66 62 00 1e  ···grfb··

```

545. Packet 69 contains an 'i2cc' SlimProto message, consistent with the message sent

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to restore volume.

```
> Frame 69: 132 bytes on wire (1056 bits), 132 bytes captured (1056 bits)
> Ethernet II, Src: VMware_a3:52:c6 (00:0c:29:a3:52:c6), Dst: VMware_83:57:01 (00:0c:29:83:57:01)
> Internet Protocol Version 4, Src: 192.168.136.128, Dst: 192.168.136.130
> Transmission Control Protocol, Src Port: 3483, Dst Port: 33001, Seq: 3417, Ack: 191, Len: 66
> Data (66 bytes)

0000  00 0c 29 83 57 01 00 0c 29 a3 52 c6 08 00 45 00  ..)·W···)·R···E·
0010  00 76 d7 d2 40 00 40 06 d0 5b c0 a8 88 80 c0 a8  ·v··@·@· ·[·····
0020  88 82 0d 9b 80 e9 31 74 fb 79 2b 20 d2 e3 80 18  ·····1t·y+····
0030  05 a8 92 bc 00 00 01 01 08 0a 03 5c 89 a4 03 3f  ······\···?
0040  90 c3 00 40 69 32 63 63 73 3e 77 68 77 e0 77 00  ···@i2cc s>whw·w·
0050  77 00 77 01 77 03 77 54 77 00 77 02 77 00 70 00  w·w·w·wT w·w·w·p·
0060  73 3e 77 68 77 e0 77 00 77 00 77 01 77 03 77 57  s>whw·w· w·w·w·wW
0070  77 00 77 02 77 00 70 00 73 3e 77 6c 77 00 77 10  w·w·w·p· s>wlw·w·
0080  77 76 70 00                                         wvp·
```

546. Packet 71 contains the 'strm' message used to tell player2 to start playing the current song in the sync group's playlist.

```
> Frame 71: 148 bytes on wire (1184 bits), 148 bytes captured (1184 bits)
> Ethernet II, Src: VMware_a3:52:c6 (00:0c:29:a3:52:c6), Dst: VMware_83:57:01 (00:0c:29:83:57:01)
> Internet Protocol Version 4, Src: 192.168.136.128, Dst: 192.168.136.130
> Transmission Control Protocol, Src Port: 3483, Dst Port: 33001, Seq: 3483, Ack: 191, Len: 82
> Data (82 bytes)

0000  00 0c 29 83 57 01 00 0c 29 a3 52 c6 08 00 45 00  ..)·W···)·R···E·
0010  00 86 d7 d4 40 00 40 06 d0 49 c0 a8 88 80 c0 a8  ····@·@· ·I·····
0020  88 82 0d 9b 80 e9 31 74 fb bb 2b 20 d2 e3 80 18  ·····1t·+····
0030  05 a8 92 cc 00 00 01 01 08 0a 03 5c 89 a4 03 3f  ······\···?
0040  90 cb 00 50 73 74 72 6d 73 30 6d 3f 3f 3f 3f 00  ···Pstrm s0m????·
0050  00 00 00 00 0d 9c 00 00 00 00 23 28 00 00 00 00  ······ ·#(····
0060  47 45 54 20 2f 73 74 72 65 61 6d 2e 6d 70 33 3f  GET /str eam.mp3?
0070  70 6c 61 79 65 72 3d 30 66 3a 35 39 3a 35 31 3a  player=0 f:59:51:
0080  36 34 3a 64 63 3a 64 37 20 48 54 54 50 2f 31 2e  64:dc:d7 HTTP/1.
0090  30 0a 0a 0a                                         0···
```

547. Packet 73 contains an 'i2cc' SlimProto message, consistent with the message sent to restore volume. The 'i2cc' payload is identical to packet 69's.

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```
> Frame 73: 132 bytes on wire (1056 bits), 132 bytes captured (1056 bits)
> Ethernet II, Src: VMware_a3:52:c6 (00:0c:29:a3:52:c6), Dst: VMware_83:57:01 (00:0c:29:83:57:01)
> Internet Protocol Version 4, Src: 192.168.136.128, Dst: 192.168.136.130
> Transmission Control Protocol, Src Port: 3483, Dst Port: 33001, Seq: 3565, Ack: 191, Len: 66
> Data (66 bytes)

0000  00 0c 29 83 57 01 00 0c 29 a3 52 c6 08 00 45 00  ..).W...).R...E.
0010  00 76 d7 d6 40 00 40 06 d0 57 c0 a8 88 80 c0 a8  .v..@.@.W.....
0020  88 82 0d 9b 80 e9 31 74 fc 0d 2b 20 d2 e3 80 18  ....1t..+....
0030  05 a8 92 bc 00 00 01 01 08 0a 03 5c 89 a4 03 3f  ....\....?
0040  90 cb 00 40 69 32 63 63 73 3e 77 68 77 e0 77 00  ...@i2cc s>whw.w.
0050  77 00 77 01 77 03 77 54 77 00 77 02 77 00 70 00  w.w.w.wT w.w.w.p.
0060  73 3e 77 68 77 e0 77 00 77 00 77 01 77 03 77 57  s>whw.w. w.w.w.wW
0070  77 00 77 02 77 00 70 00 73 3e 77 6c 77 00 77 10  w.w.w.p. s>wlw.w.
0080  77 76 70 00                                wvp.
```

548. Packet 102 contains an 'i2cc' SlimProto message, consistent with the message sent to restore volume. The 'i2cc' payload is identical to packet 69's and packet 73's.

```
> Frame 102: 132 bytes on wire (1056 bits), 132 bytes captured (1056 bits)
> Ethernet II, Src: VMware_a3:52:c6 (00:0c:29:a3:52:c6), Dst: VMware_83:57:01 (00:0c:29:83:57:01)
> Internet Protocol Version 4, Src: 192.168.136.128, Dst: 192.168.136.130
> Transmission Control Protocol, Src Port: 3483, Dst Port: 33001, Seq: 3631, Ack: 191, Len: 66
> Data (66 bytes)

0000  00 0c 29 83 57 01 00 0c 29 a3 52 c6 08 00 45 00  ..).W...).R...E.
0010  00 76 d7 d8 40 00 40 06 d0 55 c0 a8 88 80 c0 a8  .v..@.@.U.....
0020  88 82 0d 9b 80 e9 31 74 fc 4f 2b 20 d2 e3 80 18  ....1t..0+....
0030  05 a8 92 bc 00 00 01 01 08 0a 03 5c 89 ab 03 3f  ....\....?
0040  90 cc 00 40 69 32 63 63 73 3e 77 68 77 e0 77 00  ...@i2cc s>whw.w.
0050  77 00 77 01 77 03 77 54 77 00 77 02 77 00 70 00  w.w.w.wT w.w.w.p.
0060  73 3e 77 68 77 e0 77 00 77 00 77 01 77 03 77 57  s>whw.w. w.w.w.wW
0070  77 00 77 02 77 00 70 00 73 3e 77 6c 77 00 77 10  w.w.w.p. s>wlw.w.
0080  77 76 70 00                                wvp.
```

549. Packet 130 contains a 'grfd' SlimProto message, consistent with displaying the home screen after briefly showing the welcome screen.

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```
> Frame 130: 634 bytes on wire (5072 bits), 634 bytes captured (5072 bits)
> Ethernet II, Src: VMware_a3:52:c6 (00:0c:29:a3:52:c6), Dst: VMware_83:57:01 (00:0c:29:83:57:01)
> Internet Protocol Version 4, Src: 192.168.136.128, Dst: 192.168.136.130
> Transmission Control Protocol, Src Port: 3483, Dst Port: 33001, Seq: 3697, Ack: 191, Len: 568
> Data (568 bytes)

0000  00 0c 29 83 57 01 00 0c 29 a3 52 c6 08 00 45 00  ..).W...).R...E.
0010  02 6c d7 da 40 00 40 06 ce 5d c0 a8 88 80 c0 a8  .l..@.@.].
0020  88 82 0d 9b 80 e9 31 74 fc 91 2b 20 d2 e3 80 18  ....1t...+...
0030  05 a8 94 b2 00 00 01 01 08 0a 03 5c 89 d3 03 3f  ....\...?
0040  90 d2 02 36 67 72 66 64 02 30 49 fe a8 e0 a8 70  ...6grfd..0I...p
0050  a8 38 90 1c 01 fe 00 00 70 00 88 3c a8 7e 98 42  .8.....p.<~.B
0060  78 42 00 7e 00 3c f0 00 08 00 08 40 08 78 f0 3e  xB~.<...@.x.>
0070  00 1c 00 30 f8 7e a8 0e a8 38 88 40 00 00 00 00  ...0~...8.@...
0080  f8 00 a8 00 a8 00 88 00 00 00 00 00 89 fe 99 fe  ....
0090  a9 10 c9 f0 88 e0 00 00 00 00 f9 fe a9 fe a8 00  ....
00a0  88 00 00 0c 00 5e f8 52 a8 52 a8 7e a8 3e 50 00  ....^..R..R~>P.
00b0  00 00 00 60 70 78 88 3f 88 0c 88 30 70 40 00 00  ...px.?...0p@.
00c0  00 00 89 7e 51 7e 20 00 50 00 88 7e 00 7e 00 20  ...~Q~..P...~.
00d0  00 40 00 7e 00 3e 00 00 00 00 f8 38 20 7d 20 45  .@~>...8}E
00e0  20 45 f8 7f 00 7e 00 00 70 00 88 00 88 00 88 00  E...~..p.....
00f0  70 00 00 00 00 00 f8 00 40 00 20 00 40 00 f8 00  p.....@..@...
0100  00 00 00 00 f8 00 a8 00 a8 00 88 00 00 00 00 00  ....
0110  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
0120  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
0130  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
0140  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
0150  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
0160  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
0170  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
0180  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
0190  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
01a0  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
01b0  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
01c0  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
01d0  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
01e0  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
01f0  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
0200  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
0210  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
0220  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
0230  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
0240  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
0250  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ....
```

550. Release information is summarized below for the testing:

Release	Location	Notes
5.3.1	<a href="https://downloads.slimdevices.com/SlimServer_v5.3.1/">https://downloads.slimdevices.com/SlimServer_v5.3.1/</a>	The analyzed RPM and source code archives were originally downloaded from the Internet Archive, but the downloads were later determined to be binary-identical to the archives from downloads.slimdevices.com.  ZIP metadata shows source code dated 04-Oct-01.
6.2.1	<a href="https://downloads.slimdevices.com/SlimServer_v6.2.1/">https://downloads.slimdevices.com/SlimServer_v6.2.1/</a>	ZIP metadata shows source code dated 05-Nov-14.

551. The example and the evidence cited above clearly shows that the network device

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(slimserver1, slimserver2) sends an indication to the Squeezebox or Softsqueeze (e.g., player1) that it has been added to a synchronization group. That synchronization group includes one Squeezebox or Softsqueeze that is in at least one other group (e.g., player1 + player2), and both of the groups (player1 + player2 and player1 + player3) are configured to play back music synchronously when “invoked.”

1) Obviousness – POSITA

552. In the alternative, this claim limitation discloses nothing more than overlapping speaker groups, which would have been obvious to a person of skill in the art at the time. Indeed, the Squeezebox already disclosed having groups and dynamic reallocation of those groups, which indicates to a person of skill in the art that overlapping group membership is desirable, consistent with Sonos’s arguments in its summary judgment briefing. A person of skill in the art would have been motivated to add overlapping groups because Squeezebox’s own marketing materials touted the flexibility of its system to allow users to play back media throughout their household. *Supra*.

553. A person of skill in the art would have recognized that by allowing a user to create speaker groups, those groups may either (1) allow overlapping group membership or (2) not allow overlapping group membership. Given that allowing overlapping group membership may be attractive to certain users because there was a recognized “need for dynamic control of the audio players as a group,” it would have been obvious to select allowing overlapping group membership when implementing speaker groups. ’885 Patent at 2:18-19.

1) Obviousness – Nourse

554. A person of skill in the art would also have been motivated to combine the Squeezebox with Nourse, which discloses a plurality of speakers, each of which has “a unique 16-bit address.” Nourse, 3:57-58. “Each of the speakers also can be assigned up to four group identifiers.” *Id.* at 3:58-59. The group identifier “allows specific speakers to be assigned to a group

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(vii) *Limitation 1.6: “(i) receiving, from a network device over a data network, a first indication that the first zone player has been added to a first zone scene comprising a first predefined grouping of zone players including at least the first zone player and a second zone player that are to be configured for synchronous playback of media when the first zone scene is invoked; and”*

650. In my opinion, the Bose LifeStyle discloses this claim limitation.

651. Sonos discussed this claim limitation, in part, in its summary judgment briefing. As I discussed *supra* in Section X.A, Sonos argued that adding a speaker to a speaker group via a controller and sending an “indication” that need not include the “zone scene” or the players in that zone scene is sufficient to meet this claim element.

652. Bose Lifestyle discloses this behavior. As discussed above and further below, Bose LifeStyle allows for the addition of multiple rooms and zones to the be added to the Lifestyle ecosystem.

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**Setting Up Additional Rooms For Sound**

English

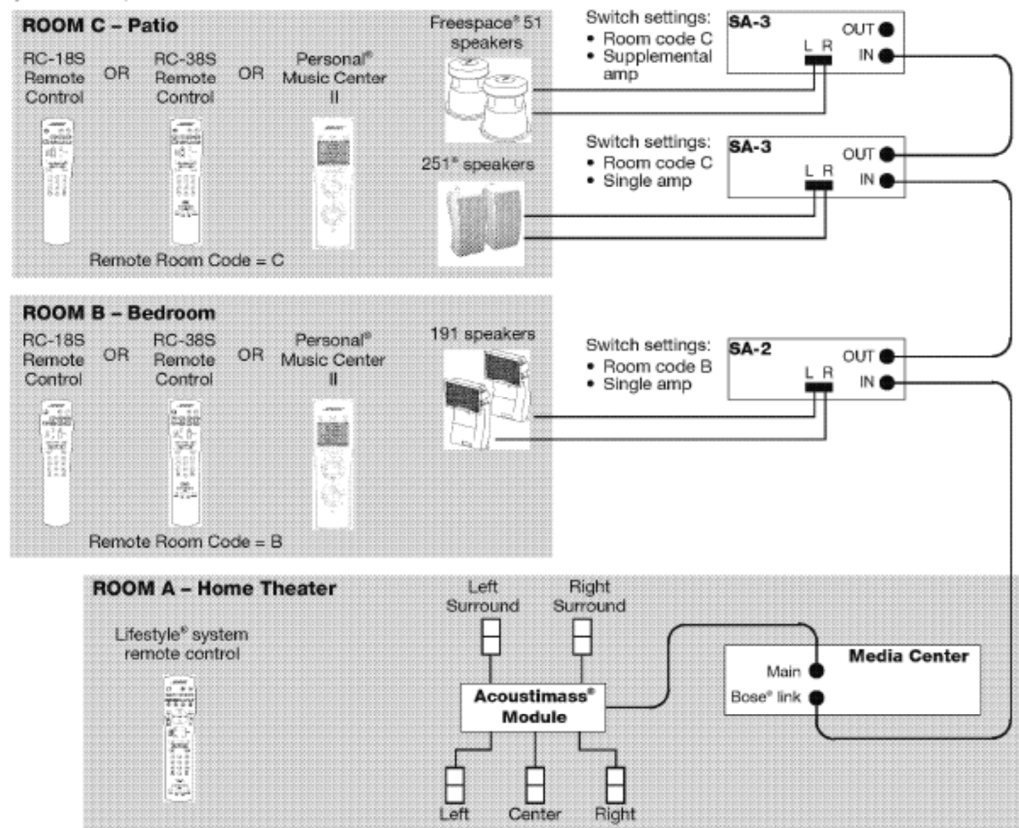
**Setup guidelines for additional rooms**

If you have a Lifestyle® 18 series II, 28 series II, 38 or 48 home entertainment system, you can experience stereo sound in up to 14 other rooms using Lifestyle® stereo amplifiers, compatible speaker systems and remote controls for the other rooms.

- Remote controls for other rooms must be set to the same house code as the main room remote, but each remote must be set to a different room code. See "Setting up remote controls for other rooms" on page 23.
- The Lifestyle® amplifier and its remote control must be set to the same room code. See "Setting up the amplifier room code" on page 24.
- When using more than one amplifier to power more than two speakers in a room (Figure 18, room C), all amplifiers must be set to the same room code. Also, one amplifier must be set to the single amp mode and all others must be set to the supplemental amp mode. See "Single and supplemental amplifiers" on page 25.

**Figure 18**

Sample installation of  
Lifestyle® stereo amplifiers



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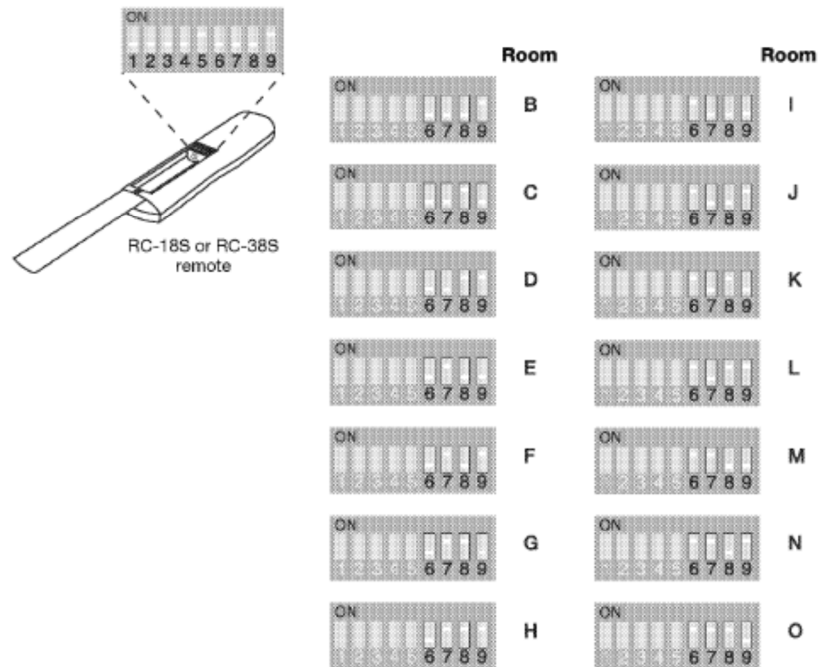
**Setting Up Additional Rooms For Sound****Setting up remote controls for other rooms****To set up the RC-18S or RC-38S remote:**

1. Remove the remote control battery cover and locate the microswitches (Figure 19).
2. Make sure that the house code settings (switches 1, 2, 3, and 4) match the house code settings in your main room remote.
3. This remote is shipped from the factory set for room B. If this remote is used beyond a second room, set switches 6, 7, 8, and 9 to the same room code as set in the Lifestyle® stereo amplifier.

**Note:** Refer to your Lifestyle® system owner's guide for more information on operating your system in more than one room.

**Figure 19**

Microswitch settings for RC-18S and RC-38S remotes

**To set up the Personal® music center II:**

Refer to the owner's guide included with the Personal® music center II for instructions on configuring this remote for other rooms.

English

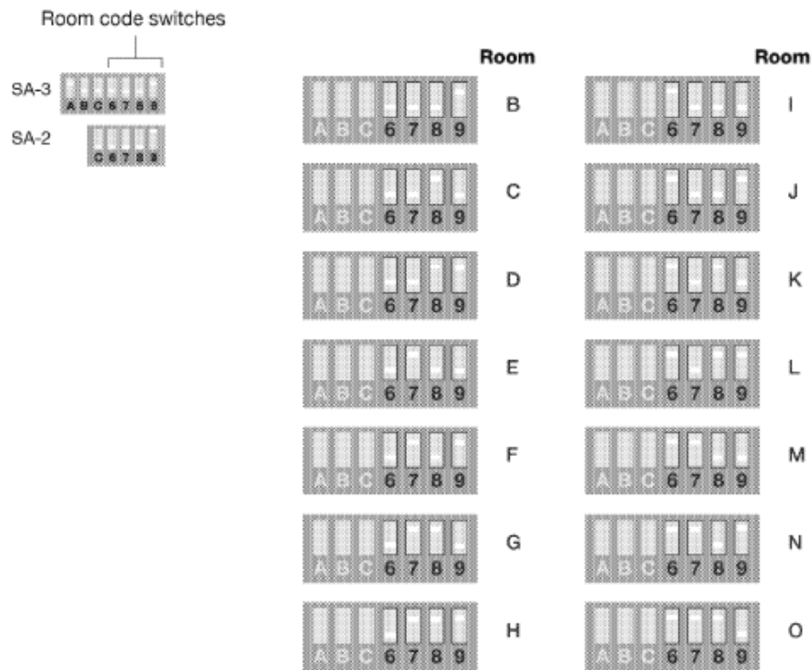
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**Setting Up Additional Rooms For Sound****Setting up the amplifier room code**

The room code of the amplifier must match the room code of the remote used in the room where the speakers are installed.

**Figure 20**

Amplifier room code settings



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653. Then, as also mentioned before, the Bose Link communication protocol allows for

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an indication that additional rooms, for example, have been added to the media center. The Bose Link connection is essentially a conversation between the media center and the expansion device. The media center sends on/off, volume and source change commands along with audio to the zones. The zones then respond by sending information back to the media center to let it know that the zone is still active. Importantly, as described below, the media center will not acknowledge commands from any zone that is not targeted or invoked (BOSE\_SUB-0000596).

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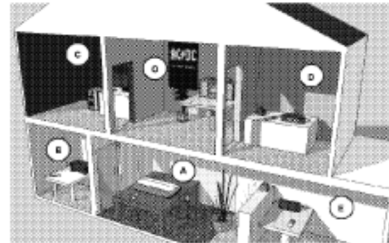


### What is Bose Link?

Bose link is a communication protocol. To communicate there must be at least two participants that speak the same language. To Bose products, Bose link is that language.

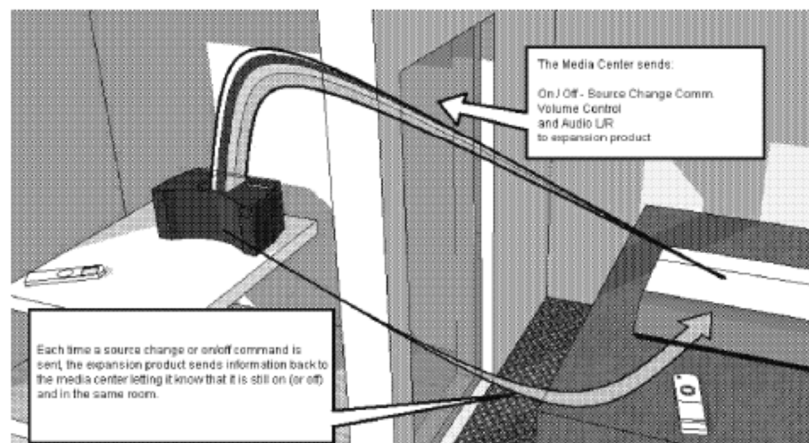
### Rooms

There are 15 different rooms that can be controlled by a Bose link enabled media center. The main room – labeled room A – is reserved for the Lifestyle speaker components. The other rooms – rooms B-O – are reserved for expansion via Bose link.



For a Bose link setup to work the system must include a Bose link enabled media center (a controller), a Bose link expansion product, and an expansion remote control. Both the expansion product and the remote must be configured to operate on the same room.

A Bose link connection is essentially a conversation between the media center and the expansion device. The media center sends on/off, volume and source change commands along with audio to the expansion product. The expansion product responds by sending information back to the media center to let it know that it is still on (or off) and in the same room. This information exchange occurs each time a power or source change command is issued by the expansion remote.



When the media center receives an ON command from an expansion remote the system turns on and checks for any Bose link products that might be connected, but it will only look for Bose link products that are assigned to the same room as the remote.

Understanding Bose® link

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BOSE\_SUB-0000595.

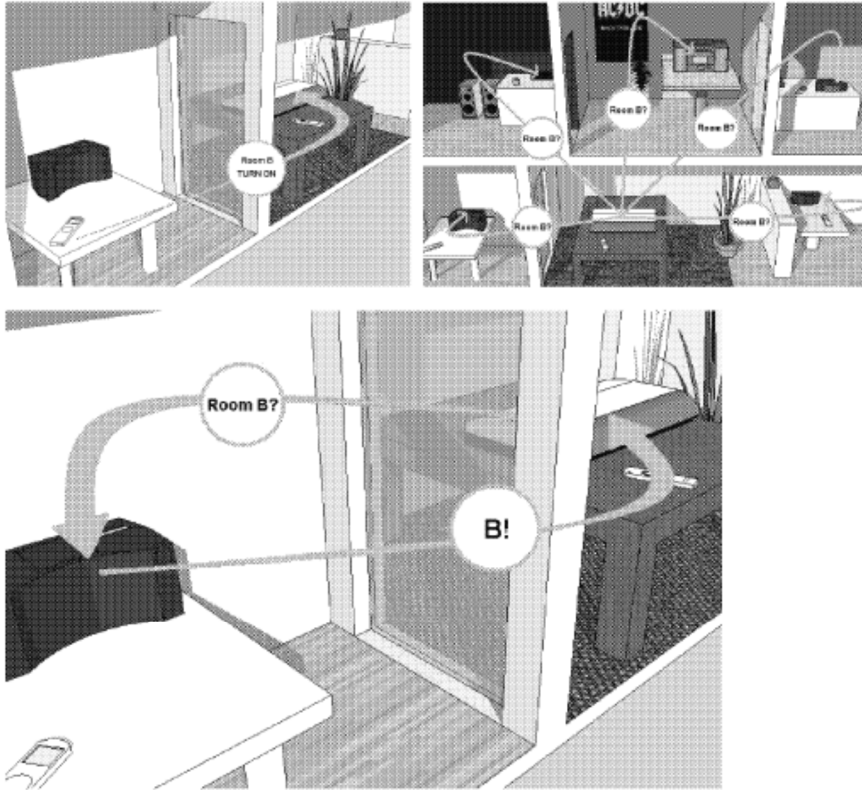
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If the media center receives a command from a remote configured for room B, for example, the media center calls out to other Bose link products which might be assigned to room B. If a connected expansion product is assigned to room B it will respond to the media center and a Bose link connection will be made. The media center will not acknowledge a response from anything not assigned to room B.



The media center will not acknowledge more than one response from the same room, either. As with any productive conversation, there can only be one person speaking at a time. If more than one product is assigned to room B the media center won't know which one to listen to. If the media center can't understand the response from the expansion products, or if there is no response at all, the media center will turn itself off and the Bose link connection will not be successful.

Understanding Bose® link

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(viii) *Limitation 1.7: “(ii) receiving, from the network device over the data network, a second indication that the first zone player has been added to a second zone scene comprising a second predefined grouping of zone players including at least the first zone player and a third zone player that are to be configured for synchronous playback of media when the second zone scene is invoked, wherein the second zone player is different than the third zone player;”*

654. In my opinion, Bose Lifestyle discloses or renders obvious this claim limitation.

655. I incorporate by reference my discussion of limitation 1.6 herein, which discloses receiving from a network device an indication that the zone player has been added to a zone scene comprising a predefined grouping of zone players that are to be configured for synchronous playback of media when the zone scene is invoked. Limitation 1.7 adds the limitation that the first zone player is a member of two different “zone scenes.”

656. In addition to the evidence disclosed in Limitation 1.7, the Bose Lifestyle expressly teaches managing two separate streaming sources at one time, such that room A can operate on stream 1, and room B can operate stream 2, for example.

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## Streams

A Bose link enabled media center is also capable of managing two separate sources at the same time. Each source can be sent to one of two different outputs - or 'streams' - within the Bose link connection. 4 of the 9 pins that make up the Bose link connection on the back of the media are responsible for delivering these streams - all of which are analog. Two pins are reserved for stream 1 audio L/R (fixed), and another two pins carry stream 2 audio L/R (fixed) - (there is another pair of pins that carry variable stream 2 audio that will be discussed later). Every Bose link expansion product has 2 inputs to accommodate each stream, and the remote control tells the device which stream to listen to. The expansion products receive fixed audio and then control volume via commands they receive from the media center carried on other pins.

### Here is an example:

If an expansion remote configured for stream 1 sends an ON command to the media center, the media center will activate the pins that carry stream 1 information. The media center will also call out to any Bose link product set to the same room code as the remote. If the media center gets an answer it can understand, it will respond by telling the expansion product to turn on and listen to its stream 1 inputs. If the media center does not get a response from an expansion product set to the same room as the remote it will simply turn itself off.

The main room, or room A, can only operate on stream 1. Although any of the expansion rooms can be configured to operate on either stream 1 or stream 2, expansion rooms are generally assigned to stream 2. Since only one source can be sent to each stream at any given time, keeping Bose link expansion products on stream 2 prevents changes made in expansion rooms from affecting what is being played in the main room, and vice-versa.

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1) Obviousness – POSITA

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657. In the alternative, this claim element discloses nothing more than overlapping speaker groups, which would have been obvious to a person of skill in the art at the time. Indeed, the Bose LifeStyle already disclosed having groups and dynamic reallocation of those groups, which indicates to a person of skill in the art that overlapping group membership is desirable, consistent with Sonos’s arguments in its summary judgment briefing. A POSITA would have been motivated to add overlapping groups because Bose LifeStyle’s own marketing materials touted the flexibility of its system to allow users to play back media throughout their household. *Supra*.

658. A person of skill in the art would have recognized that by allowing a user to create speaker groups, those groups may either (1) allow overlapping group membership or (2) not allow overlapping group membership. Given that allowing overlapping group membership may be attractive to certain users because there was a recognized “need for dynamic control of the audio players as a group,” it would have been obvious to select allowing overlapping group membership when implementing speaker groups. ’885 Patent at 1:30-34.

#### 1) Obviousness – Nourse

659. A person of skill in the art would also have been motivated to combine the Bose LifeStyle with Nourse, which discloses a plurality of speakers, each of which has “a unique 16-bit address.” Nourse, 3:57-58. “Each of the speakers also can be assigned up to four group identifiers.” *Id.* at 3:58-59. The group identifier “allows specific speakers to be assigned to a group and receive the same signal.” *Id.* at 3:61-63. Thus, any speaker “can be assigned to more than one group.” *Id.* at 4:5. Nourse is analogous to the ’885 patent because it is in the same field of endeavor, “controlling or manipulating a plurality of multimedia players in a multi-zone system.” ’885 Patent, 1:30-34. For example, Nourse, like the ’885 patent, explains that it is directed to “a centralized speaker system that allows multiple speakers connected to a central amplifier speaker line to be monitored and controlled from a central location via a master/slave protocol.” Nourse at

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experience the time-synchronized delivery of media content. *See, e.g.*, '694 patent at Abstract, 10:21-29. Both patents also reference similar hardware such as playback devices and processors as well. *See, e.g.*, '885 patent at 5:21-39, 6:28-48, and '694 patent at 4:31-65, Fig. 1.

## **XVI. RESERVATION OF RIGHTS**

755. In the event I am called upon to testify as an expert witness in this case, I may also discuss my own work, teaching, and publications in the field, and knowledge of the state of the art in the relevant time period. I may rely on handbooks, textbooks, technical literature, my own personal experience in the field, and other relevant materials or information to demonstrate the state of the art in the relevant period and the evolution of relevant technologies. I also reserve the right to rely on demonstrative exhibits to help explain the opinions set forth in this report.

756. I reserve the right to modify or supplement my opinions, as well as the basis for my opinions, in light of new positions set forth by Sonos, to the extent Sonos is permitted to advance those positions. This includes positions concerning the scope and interpretation of the asserted claim, infringement allegations, conception, diligence, and reduction to practice, and secondary considerations. It is also my understanding that Sonos may submit an expert report corresponding to this Report. I reserve the right to rebut any positions taken in that report.

I, Dan Schonfeld, declare under penalty of perjury under the laws of the United States that the foregoing is true and correct.

DATED: June 22, 2022

A handwritten signature in black ink, appearing to read "Dan Schonfeld", with a large, stylized circular flourish at the end.

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Dan Schonfeld, Ph.D